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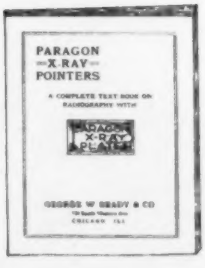

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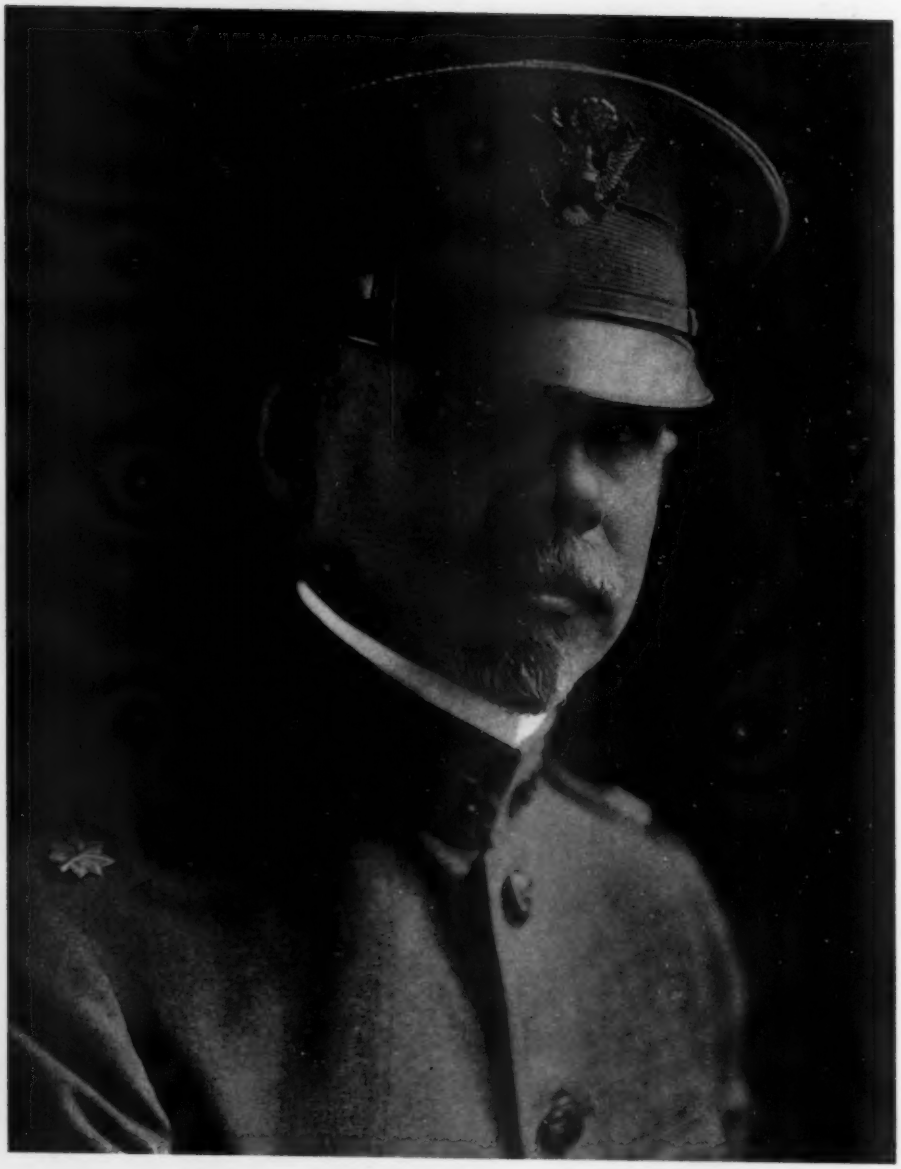

Lewis Gregory Cole

THE AMERICAN JOURNAL OF ROENTGENOLOGY

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CONGENITAL ABSENCE OR DEFECTS OF BONES OF THE EXTREMITIES

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THE subject of congenital absence or defects of bones is of interest, not only from the point of view of the biologist but also from that of the roentgenologist and surgeon. Regardless of whether a definite etiology has been worked out, the whole chapter is important from the surgical side. When a great many of these cases are reported, especially with accompanying roentgenograms, the embryologist will have a more definite working basis to unfold the etiology. No apology is needed, therefore, for the following paper, in which fourteen cases are reported.

Definitions of some of the terms applied to these conditions may be helpful.

Agenesia: Failure of skeletal development.

Hypoplasia: Partial deficiency of growth.

Ectrodactylia or ectrodactylism: Congenital absence of any of the toes or fingers.

Oligodactyly: Deficiency of fingers.

Ectromelus: A monster characterized by the presence of aborted or imperfect limbs. There are all degrees, from entire absence of a limb to simple shortening. Hemi-ectromelia is the unilateral condition.

Hemimelus: Deficient or atrophied forearms, legs, feet and hands, with normal upper arms and thighs.

Phocomelus: Shortened or rudimentary arms and thighs. The hands and feet are attached almost directly to the trunk.

Up to 1912 about 200 cases of congenital absence of the radius were reported, more than one-half of which were unilateral. The right is more frequently missing than the left and in most cases the bone is completely absent. In bilateral cases complete deficiency is the rule. Absence of the ulna is more rare.

Albee, writing in 1915, states that "according to Corner 200 cases of absence of the fibula have been collected."

Gaenslen reports seven cases of defects of the tibia and fibula as follows:

1. Bilateral defect of tibia. Both tibiæ absent, and feet in marked equino-varus.

2. Defect of upper portion of fibula. Marked talipes valgus.

3. Complete absence of fibula with an-

gulation of tibia. Only two tarsal and two inner metatarsal bones present, although the patient was four years old.

4. Defect of upper portion of fibula with marked bending of tibia and pronounced genu valgum. Two inches shortening.

5. Complete absence of fibula with shortening of leg and eversion of foot.

6. Absence of fibula. Foot in equinovarus.

7. Absence of fibula. Foot in equinovalgus. Absence of 4th and 5th toes. One hand deformed; fingers webbed. Only the bones of the thumb and 5th finger and their metacarpals present.

Hartung reports a case of synostosis and lack of development of some digits, resembling case 7 of Dr. Moore. He also shows a roentgenogram of a marked deformity of hand, wrist and forearm. It seems to be a case of split hand.

Roth reports a case of congenital defect of the ulna, the lower half of which was absent. The upper end of the radius was pushed upward past the lower end of the humerus, under the skin on the outer side of the humerus. The girl, nine years old, had only three carpal bones instead of seven. Only two fingers were present: the thumb and probably the little finger. The ulnar deflection diminished under treatment, the latter consisting of a long straight splint worn every night for two years.

He has seen four cases.

Boorstein reported two cases of congenitally short metacarpals and metatarsals.

One patient said her two sisters, an uncle, an aunt, her grandmother and four other members of the family showed exactly the same defect. He thinks that bilateral congenital malformation can generally be traced to heredity, while a unilateral congenital malformation may be explained on principles of embryonic defects.

McKnight describes a case of split foot, accompanied by the so-called lobster claw deformity of the hands. Excellent photographs and roentgenograms illustrate his article. The writer hopes to report a similar case very soon.

In a very interesting article Young reports a case of congenital absence of parts of both upper and lower extremities. He gives a good discussion of the various theories. Young reported a case of arrested development of the carpus and tarsus, with bilateral club-hand and club-foot from arrested development. He thought the probable etiology in this case was some acute infection general in character, but its exact nature unknown. He was unable to find a similar case reported in the literature.

Keibel and Mall say: "The form of the skeleton as a whole and of the individual bones which compose it depends partly upon heredity, partly upon the mechanical and chemical influences to which it is subject during growth. The variations which are a normal inheritance of the race, including such extreme forms as individuals with six toes or six fingers, are to be distinguished from the abnormalities of structure due to unfavorable environment either within or without the body. In the main the shapes of the bones and joints are inherited, but to some slight extent both bones and joints are moulded by the experience of the individual. Abnormal stress of muscular or other origin, and abnormal lack of stress, as in cases of muscle paralysis, both give rise to bones and joints abnormal in form.

"During development the skeleton is markedly influenced by internal chemical conditions affecting the growth or general nutrition of the body. The skeleton in some cases seems to be the part primarily affected. The skeletal lesions vary all the way from a retardation in the time of centres of ossification to a failure of a part of the skeleton to develop or to hyperplasia and abnormal form-differentiation.

"Agenesis or failure of skeletal development may be due either to primary lack of origin of a part or to an affection which

destroys the skeletal *anlage* after it has begun to differentiate. It is most frequently found in the cranial vault and in the vertebral arches, less frequently in the vertebral bodies and the bones of the extremities. The osseous defect is usually, but not always, associated with other marked physical deformities."

A few words about ectrodactylia occurring in the hands. The time of development of the arms is the 5th week. The thumb is detached from the fingers about the 75th day of fetal life, but the four fingers remain bound together much longer. Then the forefinger sends off a branch which becomes the middle finger and from this main branch secondary branches are sent off to form the ring and little fingers (Kirmisson).

In an excellent monograph on the ossification of the bones of the hand from the roentgenologic standpoint, J. W. Pryor concludes:

1. The bones of the female ossify in advance of the male.

2. The bones of the first child as a rule ossify sooner than those of subsequent children.

3. The ossification is bilaterally symmetrical.

4. Variation in the ossification of bones is a heritable trait.

Based on the observation of 554 children's wrists he summarized the chronology of carpal ossification as follows:

1. Os Magnum	Female:	Between the third and sixth months.
	Male:	Between the fourth and tenth months.
2. Unciform	Female:	Between the fifth and tenth months.
	Male:	Between the sixth and twelfth months.
3. Cuneiform	Female:	Between the second and third years.
	Male:	When about three years of age.
4. Semilunar	Female:	Between the third and fourth years.
	Male:	When about four years of age.
5. Scaphoid	Female:	At four years of age, or early in fifth year.
	Male:	When about five years of age.
6. Trapezoid	Female:	Between fourth and fifth years (preceding trapezium).
	Male:	Between fifth and sixth years (preceding trapezium).
7. Trapezium	Female:	Between fourth and fifth years (preceded by trapezoid).
	Male:	Between fifth and sixth years (preceded by trapezoid).
8. Pisiform	Female:	Between the ninth and tenth years.
	Male:	Between the twelfth and thirteenth years.

This table is almost identical with that of Rotch, whose work was based on a study of about 1000 cases.

According to Young the usual appearance of centres of ossification for the tarsal bones is as follows:

One for body of os calcis, sixth fetal month.

One for posterior extremity, tenth year.

One each for cuboid, ninth month.

Astragalus, seventh month.

Scaphoid, fourth year.

Internal cuneiform, third year.

Middle cuneiform, fourth year.

External cuneiform, first year.

The etiology of these conditions is unknown. There are many theories but none is satisfactory. Sex and race are evidently not predisposing factors. The following is taken from Gaenslen's article:

"1. Heredity does play a rôle but it is indefinitely established. It does not seem to play an important part in the great majority of cases. Volkmann, McKenzie and others found heredity to be of importance and undoubtedly in isolated cases there is a strong family tendency to bone defects. Joachimsthal and others suggested that the heredity factor may be of importance merely in predisposing the amnion to abnormality in development.

"2. According to a second theory, the endogenous or germinal theory, absence or defect of the long bones is dependent upon defect in the *anlage* of the skeleton. This view has been defended by Haim and Slingenberg. According to the latter, the germ defect is variable in extent resulting in corresponding defect in the long bones. If complete there will be absence of one of the long bones as well as of the corresponding tarsals, metatarsals, carpals, metacarpals and phalanges, the typical *Strahldefekt* or ray defect of Gegenbaur.

This has been referred to by Taylor in a consideration of the defects of the radius. According to this theory the arm consists of a stem and four rays. The first ray comprises the radio-scaphoid, trapezium and first metacarpal and two phalanges." (According to this theory the bony defect is always a suppression in regular order from above downwards of one or more rays and nervous influence is rather blindly invoked as a causative factor.)

"Against this theory has been urged the fact that hereditary occurrence, at least in the case of fibular defects, though claimed by Haim as confirmatory evidence is really rare; according to Hesse's statistics not over 5 per cent. A further objection raised from many sides is that it does not explain the partial defects, the cases in which a rudimentary fibula is found, represented by a mere fibrous band. Here certainly the *anlage* for bone was present, but the development was retarded. In one case functional use and massage even resulted in production of bone along the course of such a fibrous band (Parona).

"3. Defects of the fibula are frequently accompanied by a marked angular deformity of the tibia with scarring of the skin over the convexity. Busachi believed that some time early in pregnancy there had been an intra-uterine fracture due to external violence, with resulting deformity of the tibia and resorption of the fibula. This theory does not explain those cases where there is no bend of the tibia or evidence of fracture and no scar present. Sperling's work makes it appear likely that violence severe enough to cause these fractures would more easily produce abortion. It seems unreasonable that intra-uterine fractures could be produced by external violence, because the fetus floating in a menstruum of approximately its own specific gravity and surrounded by other organs is well out of range." (In Gaenslen's cases there was no history of trauma.) "Haudeck and Hoffa, after microscopic examination of excised scars, concluded they were due to long continued mechanical irritation acting from the outside and represented adhesions between the skin of the fetus and the amnion, probably due to pressure from amniotic bands."

Gaenslen says: "The theory most widely accepted today is that these bone defects are due to pressure of amniotic bands, to adhesions between amnion and fetus or to pressure on the developing fetus from an amnion which is too small. This theory, based largely on the work of Dareste and Geof. St. Hilaire, has recently been supported by Haudeck, Krebser, Scharff, Saxenberger and others. It has been shown that the amnion does occasionally suffer from inflammatory processes. It is assumed that these result in diminished production of amniotic fluid, insufficient stretching of the amnion and abnormal pressure on the rapidly growing fetus. The occasional occurrence of membranous tags and the scars above mentioned are adduced as evidence of these processes. Later in pregnancy the amniotic fluid supposedly increases and the adhesions are gradually stretched and torn. If the pressure occurs sufficiently early in fetal life, between the fifth and eighth weeks, abnormal development may result, exhibiting itself occasionally in defects of the bone, partial or complete. At this early period the fetus has already taken fairly definite form but the membranes are still in close contact with it and the bones are still in the membranous stage, hence easily influenced by pressure. The question as to whether there was at birth a decreased amount of amniotic fluid does not appear of moment in establishing the etiology, because the original deficiency may be more than made up late in pregnancy. Deficiency of the amniotic fluid later in pregnancy may be responsible for distortion of skeletal parts but could not cause the disappearance of bones already formed. The assumption that amniotic bands and adhesions are the cause of the defects in question is open to several grave objections. These defects, while showing considerable variation, in the main follow certain definite types; for

instance, the fibula defects are associated in a very large proportion of the cases with bone defects on the outside of the foot, while tibia defects are more frequently associated with similar defects involving the inside. Moreover, when the defects are bilateral there is frequently perfect symmetry. A small amnion might produce these effects but it is difficult to imagine pressure from amniotic adhesions or bands so accurately adjusted as to cause the frequent duplication of the common types of deformity on the one hand, and the absolute symmetry of the defects on the other. It is also most interesting to note how frequently, especially in the cases of fibular defects, the scar formation over the prominence of the bend in the tibia has been regarded as evidence of the theory of pressure from amniotic bands.

"This view has been objected to for several reasons. In the first place it has been urged that if these scars deserve consideration as evidence of an important etiological relationship, they should be present more uniformly. In Scharff's collection of cases they were present in only 27 per cent.; again, if the supposed bands exert pressure sufficient to cause actual bone defects the resulting scars should be found not over the tibia but over the missing fibula and with a sharp angle in the tibia not directed toward the source of pressure but away from it. Braun, in 1886, was the first to look upon these scars merely as healed pressure sores over the prominence. This view received but scant attention in the literature. In support of this explanation the writer would like to bring the fact that similar scars and also bursæ have since been found over the prominent external malleolus in extreme cases of congenital club-foot. Helbing found a similar depressed scar over the head of the prominent subluxated fibula in a case of tibial defect, and Motta described a case of tibial defect with scar over the prominent external malleolus. Craig mentioned the occurrence of a scar over the tip of a very sharp and prominent but not defective coccyx in a case of congenital tibial defect. These cases are cited to show that scars have occurred not only apart from bone defects but, if coexistent, remote from them, so that they cannot be brought into etiological relationship. This view is further substantiated by the fact that these scars have never been observed over the large flat surfaces, such as the back or at the sides of the abdomen, where closer and more intimate contact must be assumed, than over the more freely movable extremities (Young). Moreover, the scars are found with greatest frequency in cases where the angulation is sharp and are absent, as in one of my own cases, where there is but slight bending.

"If the bending in the tibia is not the result of pressure from amniotic adhesions, some other explanation must be found. Scharff has assumed that this bending of the tibia is the result of the muscular pull of the posterior and outer leg muscles acting on the foot in the absence of the prop formed by the external malleolus. No doubt this is a factor, but Holl and Schomberg (Bardeen) have called attention to the fact that in the fetus distortions of the long bones of the lower extremities are not infrequent during the period of very rapid growth, due to resistance at the extremities. This may be an important factor in producing the angulation in question, assisted by the muscular pull especially during the later fetal months when the musculature is better developed.

"From the foregoing one is therefore led to believe with Scharff and many others that the defects in question are produced for the most part by pressure from a small amnion. It is perfectly conceivable that a contracted amnion may exert equal pressure on the symmetrically placed extremities of the embryo and that symmetrical defects will follow.

"Frequent association of defects of the tibia and fibula with inner and outer toe defects respectively would seem a natural result of a pressure more widespread.

"The atrophy of the involved extremi-

ties, the partial defects and the associated defects in other portions of the body, notably in the upper extremities, may all be assumed to be the results of the same influence.

"Whether alcohol, syphilis and other toxins may be factors in the production of these deformities, as urged by some, must be left for future investigation. It is not unreasonable to suppose that they may have an injurious influence on the developing membranes.

"The subsequent history of the mother of the patient, cited as case 1, is interesting. After the birth of the child with the tibial defects, she was twice pregnant, but aborted both times. The first time the fetus was expelled at five months. It had neither arms nor legs. 'The body was smooth and round at the points where the limbs should be attached.' This was not verified by a physician, as she was without medical attendance. The second abortion took place toward the end of the fourth month and the fetus in this instance was said to have been perfectly formed.

"Without giving too much credence to these lay observations, the fact remains that she did abort twice, a significant fact if viewed in the light of Mall's Chorionic Theory[1] of the etiology of monsters, in contrast to the prevailing theory depending upon a hypothetically small amnion.

"To the writer it seems difficult to say where simple defects end and where monsters begin. Mall is inclined to consider tibial and fibular defects as hereditary. If they were included among monsters in general, the chorionic theory of the production of monsters may hold good as well for the defects in question.

"It is not the purpose to deny the possibility of hereditary influence in certain exceptional instances, particularly in those showing what the Germans style "*Exquisite Heredität*," but for the explanation of the vast majority of cases the theory assuming pressure from a small amnion lends itself better than any of the others."

In what is probably one of the most important contributions in recent years, Jansen writes:

"It is well known that the scleroblastema of the fetal skeleton begins to change into cartilage at the fifth week, whilst the formation of bone begins about the eighth week. The suitable time for the malformations of the spine therefore lies between the third week, when the condensation of the primitive cellular tissue into scleroblastema may be observed, and the eighth week, when the cartilaginous formations begin to be hardened into bone substance."

Jansen believes that the development of the amnion is sometimes retarded and that from this retardation may result a pressure on the embryo which is able to deform it, and even roll it up so as to give it the shape of a ball. In most cases we have to ascertain the fault of the amnion by inductive reasoning, as in cases of congenital club-feet, hereditary in the male line. With these the maternal parts cannot be considered to be at fault. Thus the vestiges of pressure betray the mechanical injury brought about by the coverings of the embryo itself. Very often indeed these club-feet show signs of atrophy in the skin and the subdermal cellular tissue on the top of their convexity, which are generally known as von Volkmann's "vestiges of pressure." Numerous also are the cicatrices, i. e., healed wounds which have been caused by a too narrow amnion, resembling the decubitus produced by the local pressure of a plaster dressing. We may recall the little scars, visible on the top of some cases of hemimelia, or on finger ends which through adherence to the amnion point out this membrane as the guilty cause.

The effect of pressure of the amnion may be limited to the production of varus, valgus or calcaneus positions.

In discussing ectromelia or the condition of absent or defective limbs, Jansen says:

"The question remains: How can the extremities be thus injured, whilst the trunk remains unchanged, although ex-

[1] Chronic degenerative and other changes, are in Mall's opinion, frequently the result of inflammatory processes involving the uterine mucosa. In the cases above referred to, the history gives definite evidence of such disease.

posed to the same tension? In the extremities the cartilage develops later than in the trunk: when in the sixth week the cartilage has been formed in the spine, the skeleton of the limb-buds still consists of that dense connective tissue known as scleroblastema. And it is easy to imagine a pressure which is able to affect the latter, fixed between amnion and trunk, to drive the blood out of them either partly or wholly, depriving them of their nutrition, whilst the skin as an older formation and in a condition of less active growth is little or not affected.

"The lower extremities, more exposed by their position and, moreover, backward in development compared with the upper, suffer most; and their button-shape seems to still bear the stamp of the direction in which the amnion pressure has acted. The upper extremities, affected more indirectly by the hour-glass-shaped narrowing, to which every distended elastic bag tends in the middle of its length, are pressed against the trunk. A disturbance of the circulation in a space of 2 mm here means destruction of the peripheral half of the extremity. And the conical shape of the surviving stump seems to indicate that the disturbance of circulation gradually diminishes from the periphery to the center.

"The injury which the amnion may cause to the embryo is:

"1, greatest in the stage of the non-differentiated mesoderm viz.: in the first two weeks (the first stage of development of the skeleton);

"2, less in that of the dense scleroblastema, from the third to the sixth or eighth week (the second stage of development of the skeleton);

"3, least after the eighth week, when the whole of the skeleton consists of cartilage and bone the third stage of development of the skeleton).

"It may be considered probable that the amnion has the power of destroying deep-lying parts in a perfectly normal embryo—either with or without a simultaneous injury to the skin. The same direct pressure which is unable to deform cartilage may compress scleroblastema, squeeze the blood out of it and deprive it of its nutrition. If the cartilage stage is that in which various forms of kakomelia may arise, the beginning of the cartilage stage is specially fitted to cause various forms of kakomelia in which bones are lacking."

In discussing "Amnion-decubitus" the same author says: "We may consider as such the small cicatrices at the top of extremity stumps, the peripheral part of which is wanting. The smallness of the scar (which proves that the peripheral part was small at the time of its destruction), and its being situated on the top of a solid bone are reconcilable both with the thought of an amputation by amniotic bands and with that of decubitus, but the fact that the peripheral part is wanting militates against the amputation of such bands, unless we should ascribe cytolytic powers to the amniotic fluid. That similar mutilations may occur without an amputation being effected, is proved by arm stumps at the end of which little dwarf-fingers are visible, without a cicatrix. Here the possibility should be considered of circulation-disturbance and stunting in growth in deep-lying parts by pressure.

"Summing up, it is the cartilage in achondroplasia which suffers from famine at its birth, and like the children of the slums, never outgrow the injury, never grow to reach the size of those around them, living in better circumstances. And similar may be the cause of dwarf fingers on arm stumps and other forms of partial growth-stunting.

"In short, it may have been made clear that many phenomena testify in favor of the thesis—and none against it—that:

"1. The achondroplastic is an amnion-dwarf, folded up by a dwarf amnion, by the enhanced hydrostatic pressure of which it has been disturbed in the development of its skeleton; and that

"2. The wonders of anencephaly, achondroplasia, and many forms of kakomelia

may be easily understood and arranged in chronological order, if we accept the principle that: Amnion-pressure is able to disturb the nutrition and the growth of part of the embryo, whilst the non-affected parts continue their growth."

Tubby believes the remains of amputated fingers and toes would be much more frequently found at birth if they were carefully looked for.

It seems to me that no one theory explains all the conditions found, nor does it seem at all surprising that so diverse phenomena should be impossible of explanation by one theory. The amputation theory, the ray theory, and heredity, each seems to account for some cases. Defect in *anlage* accounts for others. The amnion theory, however, is at present evidently the best and explains most satisfactorily more cases than all the others combined. The probable pathogenesis is as follows: Taking for example a case of congenital absence of the fibula and fifth toe; during that period of embryonic life when those parts are being laid down, i. e. between the fifth and eighth weeks, external pressure of a small amnion exerted through normal skin causes ischemia of the deeper structures for sufficient time to cause their death and disappearance, or causes impairment of their structural vitality to such an extent as to result in a rudimentary or defective limb.

The positive diagnosis is made by the roentgen ray. The condition can be tentatively made out by physical examination in some cases. When a child is presented with a congenital talipes valgus, absence or defect of the fibula is suspected and if the fifth, or fifth and fourth toes are missing, the probabilities are magnified manifold. The outer malleolus is found absent, and palpation reveals no fibula. In the hand a congenital abduction, especially with absence of 5th, or 5th and 4th fingers is evidence which speaks for absence or defect of the ulna. Absence of the tibia or radius is very frequently associated with absence of one or two digits on the tibial or radial border. The presence of dimples or scars leads one to suspect defects of bone.

As regards the development of missing bones, they probably never will make their appearance, as illustrated by Dr. Frankenthal's Case III. The patient was twenty years of age and showed no evidence of a fibula. If the bone is present but rudimentary, there is some likelihood of further development. The condition does not alter the prognosis as to life. The possibility of correcting the deformity is great. After the part has been retained in the proper position until the child is old enough for operation, permanent results can be obtained by transplantation of tendons and bones.

The immediate treatment consists in getting the part into the proper position and retaining it until the time for open operation is at hand. For example, if the foot is in valgus, it must be forcibly put in varus and held by means of plaster of Paris. Casts are renewed every four to six weeks. Braces may be substituted after a few months and offer the great advantage of allowing frequent bathing, massage and exercise of the parts. The shoes should have a Thomas heel. A Whitman plate may be worn. When the child is 10 to 13 years old, operations are indicated. These consist of tendon and bone transplantation. Tendons may be anchored in the bone by the Gallie technic so as to correct deformity, and bone grafts inserted to cause permanent correction and prevent recurrence. In the case of bone transplantation repeated operations may be necessary.

Albee refers to an operation for absence of the fibula, performed by Willie in 1909 as follows: "An arthrodesis was performed by driving a portion of a fibula (obtained from an amputated leg) up from the sole of the foot through the os calcis, astragalus and tibia, and obtained a fair result but without motion." Albee reports two interesting cases of defects of the fibula treated by the autogenous bone graft meth-

od with good results. He reports a case in which he secured correction of deformity of the foot due to absence of the internal cuneiform and partial absence of the scaphoid, by means of bone grafting.

Kuttner has reported a case of complete absence of the fibula, for which the fibula of a Java monkey was implanted with success.

FIG. 1. CASE 1.

Albee gives in detail his technic for the insertion of a graft for an absent long bone such as the tibia. For complete congenital absence of the radius he recommends either restoring the complete radius by a graft or preferably mortising a graft into the radial side of the ulna (at the junction of its middle and lower third) and the scaphoid bone.

FIG. 2. CASE 1.

For the correction of the valgus due to absence of the fibula H. Braun performed an arthrodesis at the ankle joint, with the foot in equinus to overcome some of the shortening. Bardenheuer secured a stable joint and corrected the valgus by splitting the lower end of the fibula and implanting in the cleft the astragalus. Joachimsthal combined the two procedures. Franke produced ankylosis between the inferior surface of the tibia and the posterior surface

FIG. 3. CASE 1.

FIG. 4. CASE 2.

of the os calcis with the foot in extreme equinus. He cut the Achilles tendon. Porter and Gaenslen used in one case a high shoe with an elevation on the inside for the pronation and secured good results. Massage, hot and cold spray and constant warmth of the leg are helpful.

The following cases I desire to report in some detail:

CASE 1.—H. B., white boy, 1 year of age. (Figs. 1, 2 and 3.)

FIG. 5. CASE 2.

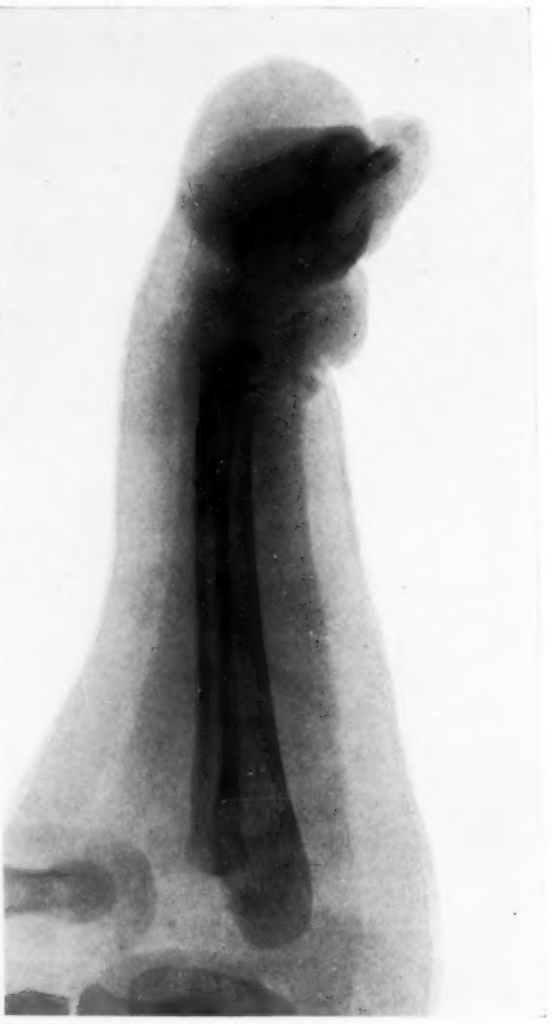

FIG. 6 CASE 2. RIGHT HAND.

The child was brought to St. Luke's Hospital on the service of Dr. J. L. Porter, because of absence of fifth right toe and valgus position of same foot. Condition present since birth. Child presented facial expression of Mongolian idiocy.

Right foot in marked equino-valgus, fifth toe absent, second and third toes fused. No fibula palpable.

Measurements. — Ant. sup. spine to patella, right 16.5 cm, left 17.5 cm. Ant. sup. spine to internal malleolus, right 26.5 cm, left 29.5 cm. *Treatment.* — Under ether anesthesia foot was put in varus position after tenotomy of tendo Achillis and peronei, and plaster cast applied. The foot to

FIG. 7. CASE 2. RIGHT LOWER EXTREMITY.

be held in slight varus by casts at first, later by leather splints, until child is older, when bone transplantation will be advised.

CASE 2. — V. H., white boy, 11 months of age.

The child was brought to Dr. J. L. Porter because of deformity of feet and right hand. (See Figs. 4 and 5.) Condition has been present since birth. He has been able to stand against a table but does not walk. Right foot in extreme equinus. When his weight is off his foot, it makes practically no angle with leg. Two toes present, big toe and one other. It looks as though the outer toes were absent. No fibula palpable. There is a small dimple in the skin over the lower end of the tibia. Left foot in extreme valgus; three toes present— big toe and two others. The fourth and fifth toes are missing. No fibula palpable.

FIG 8. CASE 2. LEFT LOWER EXTREMITY.

There is a dimple present similar to that on the right leg.

Right hand, thumb and fifth finger present. Remainder of area normally occupied by fingers consists of a soft round mass. Radius and ulna palpable. He tries to grasp objects with this hand. General health and condition of child seem perfect.

Figs. 6, 7 and 8 show the roentgenograms of the right hand, right lower and left lower extremity, respectively. The dimples, so plain in this case, are supposed to be due to either separation of amniotic adhesions or to compound fractures of tibia.

Treatment. — Under ether anesthesia at St. Luke's Hospital the left foot was put in plaster of Paris after a varus position was obtained. The right foot was placed at right angles to the foot after a splicing of the tendo Achillis was performed, and a cast was applied.

FIG. 9. CASE 3.

CASE 3. — White female, aged 20 years, referred to Dr. L. E. Frankenthal, by whose permission I report the case. Roentgenogram, Fig. 9, shows absence of the fibula. Foot in valgus.

CASE 4. — A. B., white male, aged 9 years, referred to Dr. Charles M. Jacobs, with whose consent I report the case. Double club hand. Hands at right angles to forearms. Absence of both thumbs; four fingers on each hand. (See Fig. 10.) Radius absent on left side, very rudimentary on right side and represented only by a very small upper end. Three carpal bones are present. According to Pryor's exhaustive study he should have seven, i. e. all but the pisiform. It is highly probable that those present are the os magnum, the unciform and the cuneiform. There is a peculiar notch in the carpal end of both the second and fifth metacarpal bones. (See Fig. 11.)

The roentgenograms, as shown in Figs. 10 and 11, were made in November, 1914.

Fig. 12, which reproduces a roentgenogram made in April, 1917, shows the condition at the age of 12 years and is practically identical with the original. Only three carpal bones are present instead of

FIG. 10. CASE 4.

the entire eight, and no new centers of ossification have appeared.

CASE 5. — Brought to Dr. Porter, because of deformity of right leg. White child, 5 years old.

Family History. — Two other children normal.

Personal History. — At 1 year of age, parents noticed child did not walk as soon

FIG. 11. CASE 4.

or as well as it should. Right foot seemed smaller and leg shorter than left. This has continued to grow more evident.

Condition. — Healthy child, walked on right toes. Right leg shorter than left, the difference being chiefly in the lower leg. Foot displaced outward and rotated slightly inward. Inner malleolus very prominent, outer malleolus not demonstrable.

FIG. 12. CASE 4.

FIG. 13. CASE 5.

No fibula palpable. See Fig. 13, showing absence of upper half of fibula.

CASE 6. — Patient of Dr. Porter. See Fig.

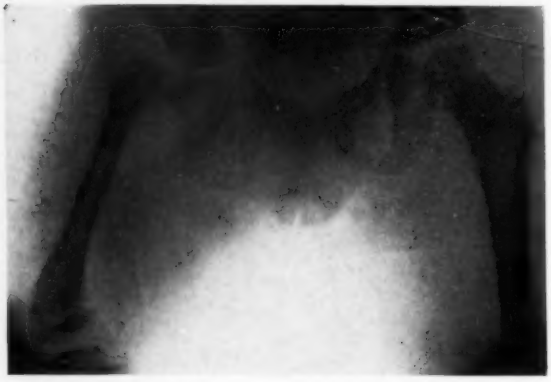

FIG. 14. CASE 6.

14, showing arrested development of femur.

CASE 7. — Patient of Dr. B. H. Moore. L. R., aged 23 years. Mother died 12 days after delivery due to infection. No similar cases in the family. Deformity of left hand. Third and fifth fingers rudimentary with deformed nails.

Fig. 15 shows carpals and metacarpals normal. Index finger has but two phalanges; fifth has a single phalanx but there can be seen the location where the two distal ones should be. Phalanges of the third and fourth fingers are represented by two very small masses of bone, approximately the size of the base of a phalanx.

FIG. 15. CASE 7.

CASE 8. — Patient of Dr. B. H. Moore. Fourth finger of right hand shorter than normal. No other cases in the family. See Fig. 16 for roentgenogram of hand showing marked shortening of the fourth metacarpal, similar to Boorstein's cases.

FIG. 16. CASE 8.

CASE 9. — Roentgenograms show marked difference in length of arms. Right: No evidence of an elbow joint. Humerus, radius and ulna rudimentary. Only three fingers present. Left: Ankylosis of lower arm at right angles to upper. No elbow joint. Only three fingers. (See Figs. 17 and 18.)

CASE 10. — J. H., white, male, 9 months old, brought to Dr. Porter because of congenital deformity of left arm.

Congenital absence of left middle fin-

ger. Thumb is short and seems to articulate with second metatarsal just below articulation with index finger. The index finger is bent toward the thumb at the second joint.

Operated on at St. Luke's Hospital. Index finger straightened. Wedge - shaped piece of skin removed between first and

FIG. 17. CASE 9.

second fingers and the two fingers approximated. Index finger straightened and cast applied. (The roentgenogram was not sufficiently distinct to be reproduced.—Ed.)

CASE 11. — C. F., white, male, 3 years of age. Brought to Dr. Porter because of double congenital talipes equino-varus. Both lower legs atrophied, right more marked. Both feet in equino-varus. Right foot smaller, more rigid and has no toes. There is a rudimentary middle toe with part of a nail present. (See Fig. 19.) Child cannot walk, shambles along on deformed feet by holding on to some object. Has never talked. Seems to understand everything, looks bright and can make parents understand by sounds and signs.

CASE 12. — White, female, referred to

FIG. 18. CASE 9.

Dr. Porter by Dr. Lindquist. Deformity of fingers and toes.

Right hand: first and second fingers fused and number of phalanges incomplete. Left hand: Index finger has but one phalanx. Fourth and fifth fingers fused. Moderate split hand. Middle finger shows annular constrictions resembling a band wedding ring.

Left foot: Second and third toes fused.

See Fig. 20 for roentgenogram.

CASE 13. — Brought to Dr. Porter. See Fig. 21 showing absence of first metatarsal.

CASE 14. — Patient of Dr. Porter.

Congenital absence of first metatarsal

FIG. 19. CASE 11.

FIG. 20. CASE 12.

FIG. 21. CASE 13.

FIG. 22. CASE 14.

bone and club-foot. Roentgenogram, Fig. 22.

I had hoped to report another case of congenital defects of legs and feet, but the patient did not live in Chicago and died of pneumonia before photographs and illustrations could be made.

In concluding it seems that the subject should be given more attention in the attempt to work out a definite etiology, as there is probably a broad fundamental principle involved which, when discovered, will add materially to the store of scientific knowledge.

I wish to express my sincere thanks to Dr. Porter, whose kindness made it possible for me to study the first and most of the subsequent cases I have seen. To those whose names are mentioned in the paper my sincere appreciation of their courtesies.

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ROENTGENOTHERAPY OF PERIPHERAL TUBERCULOUS ADENOPATHY

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(The following article appeared originally in French in *Paris Médical* for September 23, 1916, but the illustrations did not lend themselves to reproduction. Dr. Albert-Weil, in giving THE AMERICAN JOURNAL OF ROENTGENOLOGY permission to translate the article, also furnished us with the original photographs and even added a number of others which are not contained in the original article and go still further in demonstrating the effectiveness of the treatment the author has inaugurated. We extend our hearty thanks to Dr. Weil for his cordial co-operation.—EDITOR.)

SOON after their discovery roentgen rays were applied in a large number of tuberculous affections in so far as the technic, apparatus and state of the science at that epoch permitted—that is, with highly insufficient means. Nor is there anything astonishing in the fact that the results varied a great deal and that some authors refused to recognize any merit in the new method beyond the power of relatively arresting the extension of superficial tuberculous lesions, such as lupus or cutaneous tuberculides.

At the present time, however, the roentgen technic for therapeutic purposes is in a state of remarkable precision. Very thick filters are employed to arrest the rays of great wave lengths which, having but a weak power of penetration, are absorbed in the superficial layers of the skin, causing dermatitis. The rays of short wave lengths, whose power of penetration is very high and whose cellular effect is very considerable, permit without any trouble of administering far more powerful doses than formerly and, consequently, of obtaining therapeutic results even in very deep-seated lesions.

The tuberculous and ganglionic affections, whether peripheral or deep-seated, to the roentgenological treatment of which I have specially devoted myself for seven years, have benefited more than any others from the advancing technic. Furthermore, since the supposed failure of this therapy has recently been touched upon at the (French) Academy of Medicine, results should be communicated which have stood the test of time.

The peripheral tuberculous adenopathies may, according to Barjon's classification, be divided into two groups: inflammatory and suppurative. The inflammatory forms consist in certain cases of a number of ganglia in a periadenitic covering of varying thickness, although they only present the appearance of two very large ganglia which are somewhat painful. In other cases they consist of a number of hard, isolated nodules, forming a perfect chain far away from the points where the lesions are most numerous.

The forms of suppurating adenitis may be divided into closed and fistulous, the latter being more or less complicated with cutaneous tuberculosis. The closed suppurating forms may consist of a simple ganglion filled with more or less liquid pus. They have a sensation of fluctuation, do not adhere to the skin, are not red, and present the appearance of a so-called cold abscess. In "hot abscesses," on the other hand, the skin is adherent to the ganglia, and is red and inflamed.

Among the open suppurations a distinction may be made between persistent ulceration from the orifice of a ganglional abscess, old, persistently ulcerating fistulæ and phagedenic ulcerations following the ablation of suppurating ganglia.

All these differentiations were of interest when the affections had to be treated by general medication, change of climate, sea air and modifying injections. This interest is lost to a great extent now that the therapeutic roentgen technic has been perfected to a degree which enables me to state that there are no tubercular adenopathies in which roentgen treatment is not justified.

In all forms of inflammatory adenitis, roentgenological treatment alone is sufficient; it produces disintegration of the grosser lesions even without combining with it heliotherapy or sea air. These additional forms of treatment, as well as general medication, are only necessary for the purpose of combating a tubercular diathesis and increasing the patient's power of resistance.

In the closed forms of suppurating adenitis it is well to empty the pus, which forms an obstacle to the penetration of the rays, by fine aspirating needles, and then to submit the lesions to intensive roentgen treatment. In suppurating adenitis with fistulæ and cutaneous ulcerations it is a useful proceeding to establish drainage in the first place, to remove the clots and to break the skin which separates the fistulous apertures that give the lesions a scummy appearance. Iodine bandages are applied from time to time to combat the additional infection. Only after these preliminaries have been attended to should recourse be had to the roentgen rays. The latter, however, constitute the essential treatment, as mere voiding of the fistulæ and washing out the ducts are never sufficient to handle the adenopathies rapidly and cosmetically. These manipulations are only adjuvants.

I could support these statements by a large number of observations I have made for the most part during the ten years of my roentgenological service in the Trousseau Hospital, my statistics covering more than fifty cases, but I will content myself with recording a few of them.

CASE I. Figs. 1 and 2 show the appearance of the patient both before and at the end of the treatment. At the angles of both the right and left inferior maxillæ there were large, very hard, multilobular, ganglionic masses, which closed around the neck and made the lateral movements of the neck very difficult. On the left, these masses were at least as large as a fist. The growths were first noticed more than ten months ago. Eight applications of the rays, both on the right and on the left, distributed over seven months from month to month, resulted in their total disappearance so that the patient, a good looking child, had all the appearance of being completely cured. The skin in the affected regions, however, retained some of its hardness, being less supple than normal.

CASE II. (Figs. 3 and 4.)—There was a large adenopathic mass, formed by an agglomeration of several very hard ganglia under the edge of the left maxilla. Besides, there were less important ganglia under the chin and in front of the ear. These had existed for more than a year. Four series of roentgen treatments effected a total and absolute cure within five months. There remained only some very small nodules which were scarcely perceptible and are due to former old lesions.

CASE III. (Figs. 5 and 6.)—The patient was a girl, 13 years of age, whose father had died of tuberculous laryngitis a short time previously. The growth, which occurred a year ago, consisted of an adenopathy as large as a hen's egg, at the angle of the right inferior maxilla, and was of hard consistency. Two series of roentgen treatments, applied within a month, were sufficient to effect a complete cure.

CASE IV. (Figs. 7 and 8.)—The patient, who is 14½ years old, had had for the last seven months a hard adenopathic mass, as large as two oranges, at the angle of the left maxilla; and furthermore a ganglion the size of a cherry in front of the ear as well as a large ganglionic chain all along the anterior border of the sternocleidomastoid. Four series of treatments in four months, distributed over the adenopathic

FIG. 1. CASE I.
BEFORE TREATMENT.

FIG. 2. CASE I.
AFTER TREATMENT.

FIG. 3. CASE II.
BEFORE TREATMENT.

FIG. 4. CASE II.
AFTER TREATMENT.

FIG. 5. CASE III.
BEFORE TREATMENT.

FIG. 6. CASE III.
AFTER TREATMENT.

FIG. 7. CASE IV.
BEFORE TREATMENT.

FIG. 8. CASE IV.
AFTER TREATMENT.

FIG. 9. CASE V.
BEFORE TREATMENT.

FIG. 10. CASE V.
AFTER TREATMENT.

masses in three regions, effected a diminution in size and a reduction of the nodules, keeping step with the healing process. An electrotherapeutic treatment which was instituted later for a slight cellular infiltration served to render this happy cosmetic result complete.

CASE V. (Figs. 9 and 10.)—This patient had a large adenopathic mass, the size of a hen's egg, which was a little indurated below the lobe of the left ear. The growth started three weeks ago. Two series of roentgen rays effected a complete cure in three months.

CASE VI. (Figs. 11, 12, 13 and 14.)—A boy, 7 years old, with a rather wretched

FIG. 11. CASE VI. BEFORE TREATMENT.

FIG. 12. CASE VI. AFTER TREATMENT.

FIG. 13. CASE VI. BEFORE TREATMENT.

FIG. 14. CASE VI. AFTER TREATMENT.

appearance, contracted several months ago very large adenopathic masses which occupied all of the right side of the neck from the lobe of the ear to the subclavicular region, measuring 9 cm in length and 15 cm in width. They could easily be palpated as a number of ganglia the size of prunes and of medium hardness. The ganglia prevented the wearing of any clothing around the neck and compelled the child to hold his head inclined to the left. The boy lived in the country and was taken to the hospital on four different occasions for several days, to receive roentgen ray treatment. Six months after the last application, the original adenopathies had shrunk to very small nodules and could only be recognized by very careful palpation.

CASE VII. (Figs. 15, 16, 17, 18, 19 and 20.)—This young woman had suffered for two years from lupus at the end of the nostrils and below the nose. Besides, there was a chain of deep adenopathies extending from one inferior maxilla to the other. These adenopathies were ulcerating and accompanied by budding cutaneous lesions which were in the nature of swellings all around the fistulous openings. They secreted thick pus which consolidated into thick crusts adhering over the ulcers. The appearance was repulsive. Roentgen rays were applied in five series for a period of six months which caused the adenopathies to disappear, the wounds to cicatrize and the budding excrescences to become flat. A smooth skin formed without cavities and without scars. The nasal lupus alone required a little more time before it was healed.

CASES VIII, IX, and X. (Figs. 21 to 27.)—These roentgenograms likewise show the satisfactory effect of the roentgen rays in severe cases of tuberculous adenopathy.

The technic I have employed to obtain these results which, I venture to say, are of dependable constancy, is the following:

I divide the skin over the adenopathic masses as much as is necessary to allow each part of the surface to receive a practically equal share of rays. I apply hard rays of 8 or 9 Benoist, filtered through 4 mm of aluminum, over each surface. These

applications are repeated over the same region, until each port of entry has absorbed 10, 12 or sometimes even 14 H, the units being determined either by direct measurement, or by Bordier's chromoradiometer, or by means of Guilleminot and Belot's absorption tables.

absorption phenomena, which have to be expected, may not assume an extreme degree of suddenness. With the exception of certain cases of soft adenopathies with rapid development, which are rather manifestations of lymphadenia than tuberculosis, I have never observed with this

FIG. 15. CASE VII. BEFORE TREATMENT.

FIG. 16. CASE VII. AFTER TREATMENT.

FIG. 17. CASE VII. BEFORE TREATMENT.

FIG. 18. CASE VII. AFTER TREATMENT.

FIG. 19. CASE VII. BEFORE TREATMENT.

FIG. 20. CASE VII. AFTER TREATMENT.

The apparatus at my disposal do not permit, in view of the great number of patients to be treated at the hospital, of administration of the total dose at one sitting. Even if I had the choice to do so, I would not have recourse to it in a general way, because I prefer to distribute the total dose—which may appear excessive to those who still employ rays filtered through 1 or 2 mm aluminum—over five or six consecutive doses, so that the organism will not be unnecessarily shocked and the method of treatment any very strong reaction with elevated temperature. If, on the other hand, cancerous affections are treated with the roentgen method, it often happens that at the beginning of the treatment a positive toxemia will result.

The roentgen treatment, as carried out with the intensity which I recommend and endorse, is rendered possible by high filtration and causes neither any rapid growth of the ganglionic masses nor any spreading of the tuberculous condition. Those au-

FIG. 21. CASE VIII. BEFORE TREATMENT.

FIG. 22. CASE VIII. AFTER TREATMENT.

FIG. 23. CASE IX. BEFORE TREATMENT.

FIG. 24. CASE IX. AFTER TREATMENT.

FIG. 25. CASE X. BEFORE TREATMENT.

FIG. 26. CASE X. BEFORE TREATMENT.

FIG. 27. CASE X. AFTER TREATMENT.

thors who have observed rapid growth of the adenopathies—the "*coup de fouet*"—have simply applied insufficient doses. If modern results have shown that it is dangerous to apply overdoses on account of radiodermatitis supervening, it is equally dangerous sometimes to administer weak doses, since they excite the cells to new-formations instead of arresting their vitality.

Authors who accuse roentgenotherapy as causing the spreading of tuberculous conditions misinterpret the facts. Roques, working with a much less exciting technic than mine, states that his treatment has never led to metastases which might—not with scientific certainty but with clinical probability—have been imputed to it. So far as I am concerned, I have only seen once in the numerous cases I have treated both at the Trousseau Hospital and in town, a spreading of tuberculous conditions to occur. This happened six months after the last roentgen application in a cachectic patient who was already deeply infected before the roentgen treatment was instituted.

Roentgenotherapy, therefore, if applied with due intensity and proper technic, should be the indicated remedy for peripheral tuberculous adenopathies. It certainly does not exclude heliotherapy nor sea air treatment, both of which have a general and a local effect; but the fact that roentgen rays alone are successful in hospital surroundings and in children who are not treated in hospitals and live in deplorable hygienic conditions, is the surest and most irrefutable demonstration of its high value.

LOCALIZATION OF FOREIGN BODIES

BY LEWIS GREGORY COLE, M.D.

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NEW YORK

SOME observers say that there are more than two hundred methods for the localization of foreign bodies, others that there is only one method with various modifications. There is little that is distinctly new in the method I am about to describe. It is based on a redescription of a method employed and published in 1902.[1]

I have attempted to bring the method up to date by embodying the principles of several methods used at the front.

Three things are essential in the localization of foreign bodies: accuracy, speed, and simplicity. Many of the methods have two of these essentials, but few if any have all three.

I wish here to express my appreciation of Sir Mackenzie Davidson's method as the one method, if all others are to be considered modifications. I wish also to give due credit to the following men whose methods have been incorporated in the one I am about to describe: to Morize for the ring-pointer, and to Bowen for his modification of the ring-pointer; to Haret for the double exposure with the shift of the tube between exposures; to Thurstan Holland for his mechanical square by which he obviates the necessity for mathematical calculations; to Sutton for his cannula and trocar; to Flint for his profundameter; and to Jordan for his pointer acting as an indicator on the surface of the body. The method about to be described is best employed as a combined fluoroscopic and roentgenographic procedure, but when the image of the foreign body is readily visualized, as in an extremity or small part of the body, it may be employed solely as a fluoroscopic method. But if the fragment is too small to be recognized fluoroscopically, a complete roentgenographic technic is necessary.

Any type of apparatus may be employed,

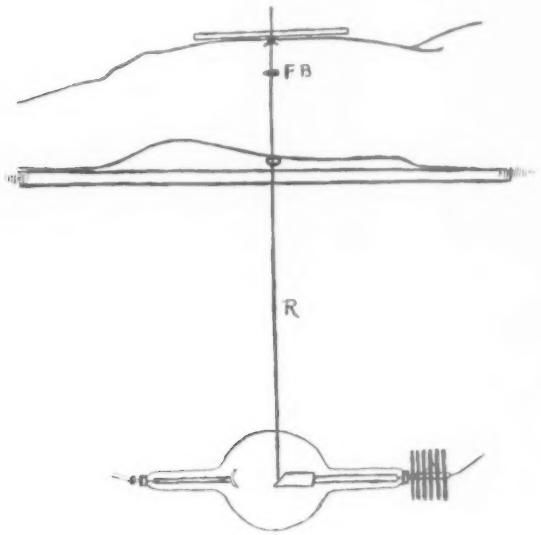

FIG. 1.

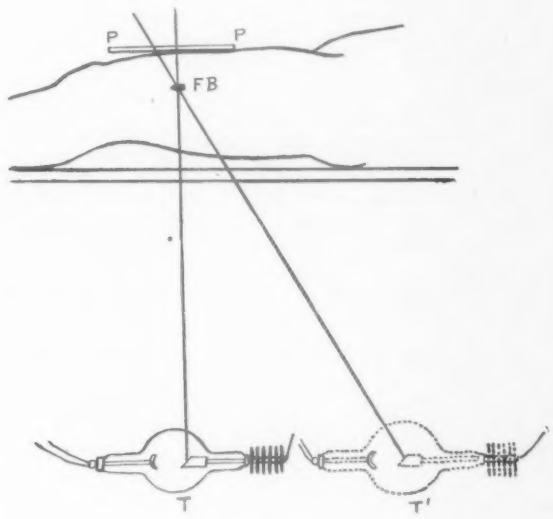

FIG. 2.

[1] *Medical News*, March 19, 1902. Even at that time it is doubtful if the principle was new. I believe Parany described this method even prior to that time.

but the new field hospital table is well suited for this method.

The principle of the method is simple and is composed of two steps. A vertical ray (Fig. 1, R) passes through the foreign body (F B). The point of entrance and exit is marked on the skin of the patient and thereby one determines that the foreign body lies between the two points marked X on the anterior surface and O on the posterior surface.

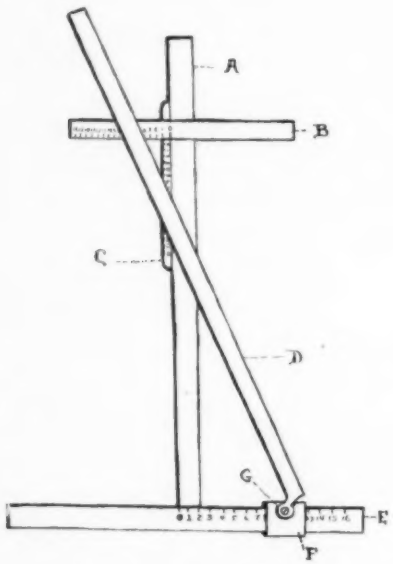

FIG. 3. SLIDING SCALE.

A second step (Fig. 2) is to determine the distance of the foreign body from the anterior or posterior mark. To do this a plate (P P) or fluoroscopic screen is placed in approximation to the skin directly opposite the tube T and the exposure is made, and then without removing the plate or the body the tube is shifted 15 centimeters from the vertical ray (T′) and a second exposure is made on the same plate, or if the examination is made fluoroscopically the shift of the image on the screen is recorded.

The sliding scale employed by Thurston Holland (Fig. 3) will avoid mathematics. The modified T square for rapid calculation of depth of the foreign body consists of a base (E), supporting an upright (A), which has mounted near its upper end a sliding arm (B). A long oblique arm (D) is fastened to a sliding base (F) by a hinged joint (G). The upright is fastened to the base by a hinged joint. Extending downward on A from the cross-arm (B) is an insert (C). These arms are calibrated in centimeters or inches as shown in the diagram.

The sliding base (F) is set at a point away from the upright (A), the distance corresponding to the tube shift. The arm (D) is set on the arm (B) so as to correspond with the shadow shift as measured on the film or screen, the arm (B) having previously been set on the upright (A) at a point at which the distance B-E is equal to the target-screen distance. The intersection of D with C indicates the depth

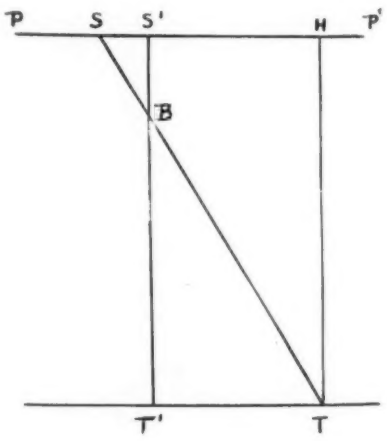

FIG. 4. CALCULATIONS.

PP′ = Plate or screen
T′T = Tube shift parallel with the plate
SS′ = Shadow shift
S′T′ or TH = Tube plate distance
SHT′ = The large right angle triangle
SS′B = Small right angle triangle

Now the base of the greater triangle SHT′ is to the base of the lesser triangle SS′B as the altitude of the greater is to the altitude of the lesser, that is

SH : HT : : SS′ : S′B, or

if the tube plate distance were 50 cm. and the tube shift 15 cm. and the shadow shift 2 cm. substituting these values in the above equation

17 : 50 : : 2 : X.

solving: X 5 15 /17 cm. = depth of the foreign body below the skin surface.

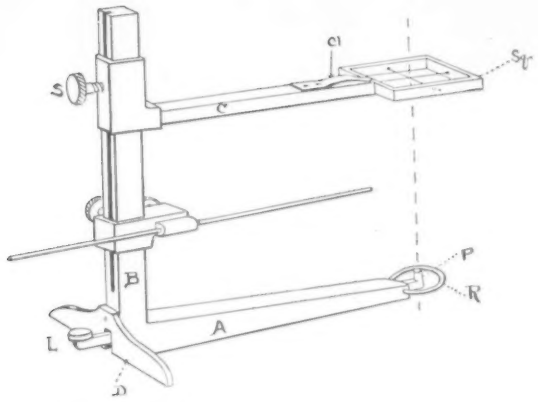

FIG. 5. ROENTGENOLOGISTS' CALIPER.

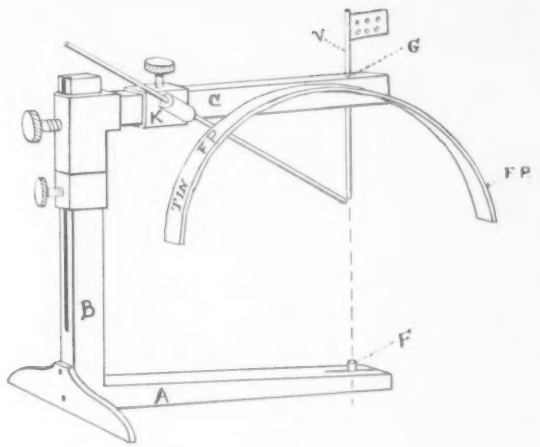

FIG. 6. SURGEONS' CALIPER.

of the foreign body. This is a rapid method obviating the necessity of solving geometrical proportions.

In order to simplify this and accurately convey the information to the surgeon, the author has devised a double set of calipers, one for the roentgenologist and one for the surgeon.

The roentgenologists' caliper (Fig. 5) is composed of a horizontal arm (A), which rests on the table, a vertical square rod (B), and a movable horizontal arm (C) which slides up and down on the vertical rod, its direction always being parallel to the lower horizontal arm (A). This upper rod (C) rests on the surface of the part examined. A base (D) for holding the vertical rod perpendicularly is attached to the lower end of the vertical rod. There is a set screw (S) on the upper rod which fixes it at the height where it rests on the body. At the distal end of the lower horizontal arm there is a ring (R) through which the vertical ray passes. This is adapted from Morize's ring-pointer. In the center of this is a plunger (P) which marks by the application of indelible ink the point of entrance of the ray on the skin (Bowen's modification). At the end of the upper horizontal arm there is a square (Sq) with cross wire and the vertical ray passes through the center of the ring and hits the center of the cross wire. Just above the cross wire is a clamp (Cl) which holds a dental film or small cassette in place. The vertical rod is calibrated on one side in centimeters and on the other in inches for the thickness of the part. Thus the thickness of the part is indicated on the vertical rod and this plus the tube table top distance gives the tube plate distance. This is the roentgenologists' caliper.

A caliper of identical dimensions and similar construction is employed by the surgeon (Fig. 6). At the lower arm (A) of the surgeon's caliper is a pin (F) which engages in the hole of a washer attached to the skin of the patient, at the site of the posterior mark, by a large strip of adhesive plaster. At the distal end of the upper horizontal arm (C), at a point corresponding to the cross wires of the roentgenologists' caliper is a small vertical hole (G) directly in line with the metal pin (F) on the lower arm. The hole is just large enough to guide a Sutton trocar and cannula, or a metal rod (V), as an indicator. There is a semicircular piece of block tin (F P), similar to Flint's profundameter, but without hinges, which lies on the skin parallel to the upper horizontal arm and is moulded to the upper aspect of the part. The mid-line of the part (Fig. 7, M L) and the position of the cross-wires are indicated on the profundameter so that the profundameter may be used with a cross sectional anatomy to determine the relation of the foreign body to important an-

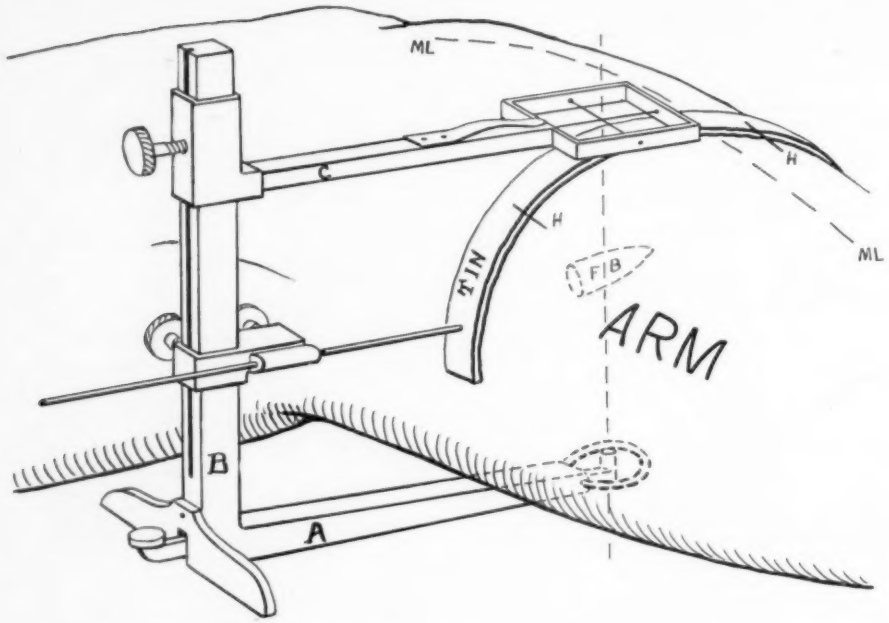

FIG. 7. ROENTGENOLOGISTS' CALIPER, SHOWING POSITION OF PART IN PLACE.

atomical structures. There is a small block (Fig. 6, K) adjusted by means of a set screw, carrying a thin rod which guides the surgeon in case the incision is not in the direct line of the vertical ray. The rod is so constructed that it may be set so as to allow of approach by the surgeon from any angle and may be employed either on the vertical or the upper horizontal rods in a manner similar to the indicator on the original Mackenzie Davidson apparatus.

The roentgenological procedure is as follows:

First Step. One detects fluoroscopically and notes approximately the size, shape, and number of foreign bodies present.

Second Step. The tube is placed so that the vertical ray passes through the foreign body. This is accomplished by closing the diaphragm until the illuminated area on the screen is approximately the size of the foreign body, and the foreign body appears in the center of the illuminated area (Fig. 8).

Third Step. Then, without removing the tube or the plate, open the diaphragm and place the lower horizontal arm (A)

FIG. 8.

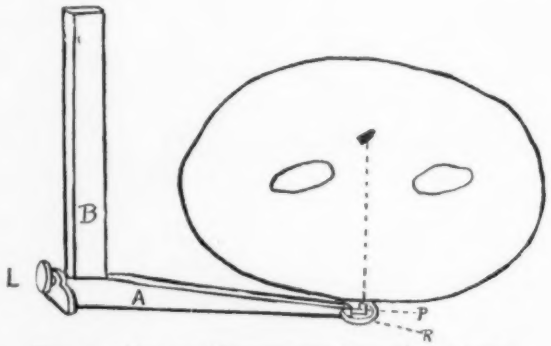

FIG. 9A

FIG. 9. USE OF ROENTGENOLOGISTS' CALIPER. FIRST STEP.

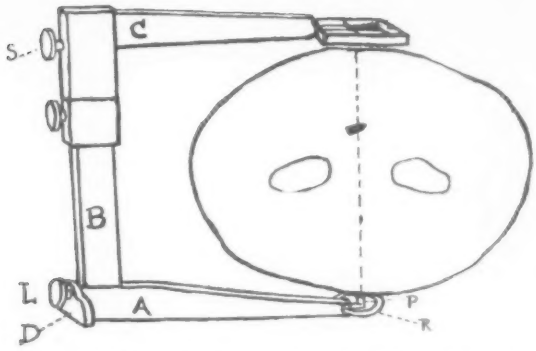

FIG. 10. USE OF ROENTGENOLOGISTS' CALIPER. SECOND STEP.

so the central shadow of the ring coincides with the foreign body (Fig. 9), giving the image Fig. 9*a*.

Fourth Step. Place the upper horizontal arm (Fig. 10, C) on the vertical rod (B) so that the cross wires shall correspond with the ring, giving the image in Fig. 10*a*. If the center ring and the cross wires do not coincide the tube is not centered beneath the diaphragm and should be readjusted.

Fifth Step. Press the lever (L) which causes the plunger to mark the posterior surface at the central point of the ring and mark the skin beneath the cross wires with indelible pencil.

Sixth Step. The next step is to insert the film or small cassette beneath the clamp on the upper arm and make the exposure. Then shift the tube in the longitudinal direction of the table 15 centimeters from the vertical ray and make a second exposure without moving the film or the part.

FIG. 10A.

Seventh Step. Place the block of tin (profundameter) so that it encircles the upper half of the part parallel to the upper horizontal arm, indicating both the midline of the part and the cross-wires on the profundameter with adjustable markers. This profundameter is then employed with a cross sectional anatomy.

Eighth Step. Develop the film and measure the distance between similar points on the two images; this indicates the shadow shift. Estimate the depth by constructing a geometrical figure, or use the sliding scale described to avoid mathematical calculation.

The surgical caliper is readily separated into two parts—an upper horizontal arm and the lower. The entire caliper should be sterilized, but the lower arm may not remain sterile, while the upper arm and indicating rods must remain so.

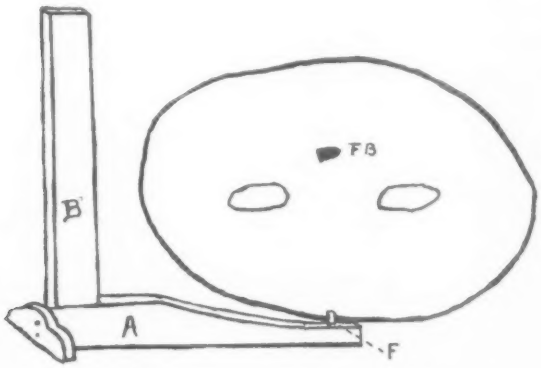

FIG. 11. USE OF SURGEONS' CALIPER. FIRST STEP.

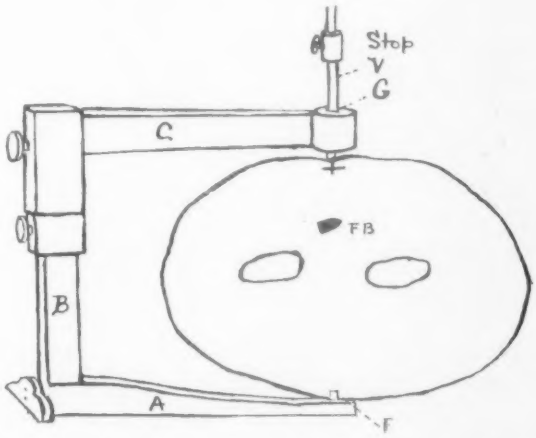

FIG. 12. USE OF SURGEONS' CALIPER. SECOND STEP.

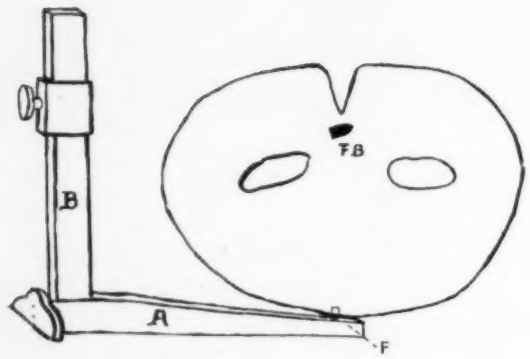

FIG. 13. USE OF SURGEONS' CALIPER. THIRD STEP.

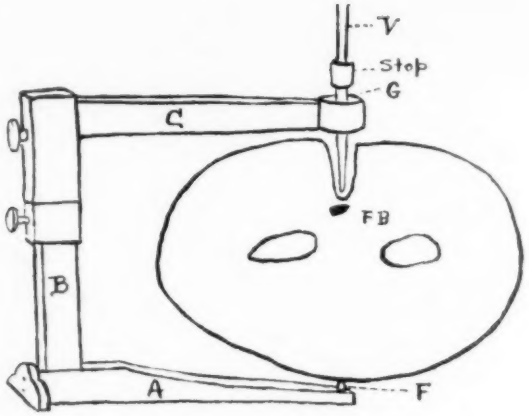

FIG. 14. USE OF SURGEONS' CALIPER. FOURTH STEP.

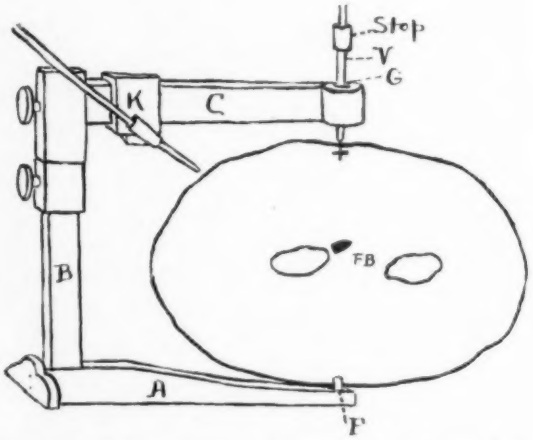

FIG. 15. USE OF THE OBLIQUE INDICATOR ROD WITH SURGEONS' CALIPER. FIRST STEP.

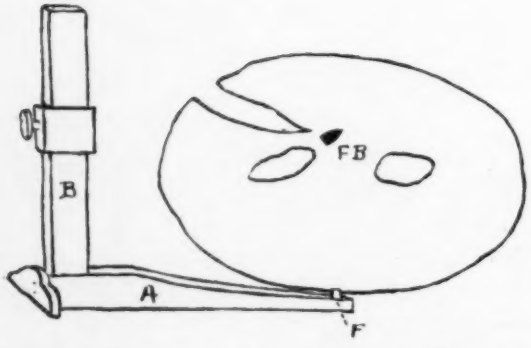

FIG. 16. USE OF OBLIQUE INDICATOR ROD WITH SURGEONS' CALIPER. SECOND STEP.

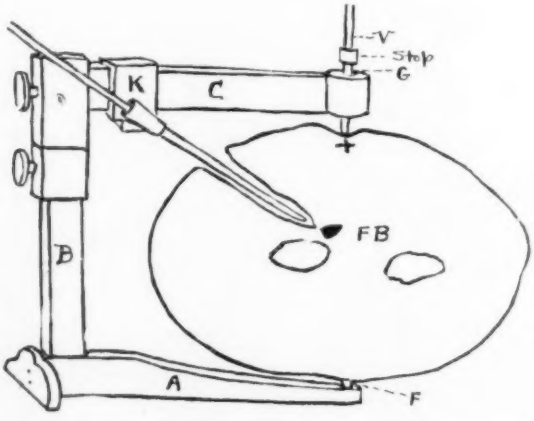

FIG. 17. USE OF OBLIQUE INDICATOR ROD WITH SURGEONS' CALIPER. THIRD STEP.

The method of applying the surgical caliper by steps is as follows:

First Step. Place the lower horizontal arm (A) of the surgical caliper under the part in such a position that the pin (F) on the distal end engages in the hole of the washer (Fig. 11).

Second Step. Adjust the patient in approximately the same position that he was in when the localization was made.

Third Step. Place the upper horizontal arm (C) in position with its under surface resting on the skin and adjust the patient without removing the lower horizontal arm until the center of the cross on the anterior surface of the skin is beneath the small hole (G) in the distal end of the upper arm (Fig. 12).

Fourth Step. Place the vertical indicating rod in the hole and let the end rest on the skin at the center of the cross.

Fifth Step. Place the stop (Stop) on the indicating rod (V) at the distance above the horizontal rod (C) that the foreign body is beneath the skin, and fasten by set screw.

Sixth Step. Place the small block that slides up and down on the vertical rod against the under surface of the upper horizontal rod, and fix with set screw.

If the line of incision is to be through the anterior cross, place the profundameter in position and mark points on the skin (H H, Fig. 7) and on the profundameter to correspond. These points should be so placed that if the surgeon desires to reorient himself at any future time, he may do so by again placing the profundameter on the same given points.

The indicating rod which shows the depth of the foreign body beneath the skin should then be introduced and the stop (Fig. 12, X) will indicate accurately the depth of the foreign body. Should it be necessary, the rod may be lowered to the depth of the foreign body, as follows:

The upper arm is removed without removing the lower horizontal arm, the latter remaining fixed by its point in the washer. The incision is then made to approximately the depth of the foreign body (Fig. 13, F B).

Then if the body is not found, the upper horizontal arm is replaced and the indicating rod is pushed down to the stoplock and the end of the rod indicates the location of the foreign body (Fig. 14).

If the surgeon wishes to make his incision in the line of the anterior mark, the indicator or guide directs him accurately to the foreign body. If, however, the surgeon desires to make the incision at any point in the circumference other than the anterior cross, the oblique indicator must be used and the procedure is as follows:

Before the caliper is placed beneath the patient, the upper horizontal arm is placed in position, at the height of the thickness of the part previously determined by the roentgenologist's report.

The sliding block which carries the oblique indicating rod is then placed against the under surface of the upper arm and the set screw tightened, and the vertical indicator with the stoplock is set at the same distance above the upper arm that the foreign body-skin distance is from the surface (Fig. 15).

Then the vertical indicator is lowered until the stoplock rests on the upper end of the horizontal arm, the point of this registering the depth of the foreign body.

The ends of the vertical and oblique indicating rods are then brought into apposition and set in this position.

The stop on the oblique indicating bar is adjusted in apposition to the stoplock on the oblique rod and securely fastened in this position.

The upper horizontal rod and vertical indicator are then removed and the oblique indicating rod withdrawn.

The incision is then made to approximately the depth of the foreign body (Fig. 16).

Should the surgeon desire to confirm the previous observations, the oblique rod may be again inserted and observation made (Fig. 17).

NOTE. I wish to express to the following men my appreciation of their help and suggestions in the development of these calipers and the preparation of this article: Capt. Howard E. Ashbury, Capt. Francis S. Borzell, Capt. Ralph S. Bromer, Capt. Leopold Jaches, Lieut. William W. Mazer, Lieut. Alexander B. Moore, Lieut. Eugene V. Powell.

THE ROENTGEN DIAGNOSIS OF PULMONARY TUBERCULOSIS *

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THE physical examination of the chest for the detection of lesions of pulmonary tuberculosis is not an exact science, but is open to numerous sources of error, although the diagnosis is made correctly in the large majority of cases. The discovery of the tubercle bacillus in the sputum is the one unfailing proof of the disease, but unfortunately this positive test is not always possible, and especially in early cases, in which a definite diagnosis is so essential to the welfare of the patients. Any method of examination that could be proven dependable and accurate in all instances and especially in doubtful cases would be of extreme value. Many years ago, when the roentgen examination of the chest was beginning to give promise of future possibilities, it was the hope of roentgenologists that it would become the means to such an end. During the past few years they have devoted much time and thought to the perfection of technic and perhaps too little study to pathology and anatomy. The first has been most essential, but it is unfortunate that so much of our energy has been required in the technical development of a rapidly progressing science. As a result, our failure to develop diagnostic skill by clinical methods and our tendency to disregard the necessity of intimate familiarity with the pathological and histological features of the disease under discussion have no doubt earned for us some just criticism from the clinician. This should, however, react advantageously by promoting a greater desire for accuracy, and many of us now realize the necessity of help from the clinician and pathologist in the development of the roentgen diagnosis to its greatest field of usefulness.

The roentgen examination in pulmonary tuberculosis should prove useful in two distinct types of cases. In the first place, it should serve the purpose, when needed, of confirming a positive and certain clinical diagnosis and demonstrating the exact location, extent and nature of the lesion. Secondly, and far more important than this, it should be dependable as a means of diagnosis in the case with suspicious but doubtful signs and negative sputum. Granting the possibility of demonstrating definite pathological lesions by the roentgenograms, the really important bone of contention between the clinician and the roentgenologist at the present time is the possibility of determining a definite etiological diagnosis from certain typical roentgenographic appearances, irrespective of the presence or absence of physical signs. The roentgenologist has but three ways of proving his contention,—by conformation between the supposed roentgen characteristics and the physical signs, by subsequent progress of the case, and by autopsy. The autopsy is the absolute proof but the one that is seldom forthcoming, and certainly not often when most needed, unfortunately for us but fortunately for the patient. It would seem, therefore, that the clinician and the roentgenologist must come to an amicable agreement, and the sooner this is accomplished the better for all concerned. It should be borne in mind, however, that the one great aim of the roentgenologist is to assist the clinician where he most needs

* Read before the Laennec Society of the Johns Hopkins Hospital, Baltimore, March 26, 1917.

assistance and not to attempt to take over his work *in toto*. It is the object of both of us to help each other for the good of mankind.

Experience has shown that there are two requisites for accurate roentgen diagnosis in pulmonary tuberculosis. The first of these is a comprehensive working knowledge of the pathology of the disease and the anatomy and histology of the lungs, without which as a foundation it is idle to advance theories and propound facts. The second requisite comprises a proper technic for the examination and the experience necessary for correct interpretation. It is interesting to note that the roentgen ray was used in the diagnosis of this condition soon after its discovery. Francis H. Williams[1] in his book reported many cases examined by the fluoroscope in 1896. In the third edition, published in 1903, he mentions as the fluoroscopic signs,—"The diseased portion of the lung or lungs is darker than usual, owing to its increased density." "The diaphragm is restricted on the affected side or sides, and usually in the lower part of its excursion." "The heart may be drawn toward the affected side, especially during deep inspiration. The same observations are still made and recorded in our examinations of the present day, but from the standpoint of an etiological diagnosis they have but little bearing, as they are by no means distinctive of tuberculous infection. From his conclusions as to the value of the roentgen diagnosis by fluoroscopy and roentgenography, we would quote the following:—"The signs afforded by the *x*-rays in tuberculosis are not pathognomonic of the disease." "In making successive *x*-ray examinations of patients who were suffering from tuberculosis at one apex, as indicated both by an *x*-ray and a physical examination, in order to watch the progress of the disease, I have observed that as the process went on, signs were evident in the other apex, by an *x*-ray examination, before there were physical signs there. Likewise, I have seen by a single *x*-ray examination, when tuberculosis was well advanced, that the disease was more extensive than the physical examination indicated." Finally, he states:—"The *x*-rays give another and valuable method for controlling the results obtained in other ways, and also add to them." These statements in a large measure still hold good, a fact which is rather surprising when we also note the quotation:—"Thus far I have been able to detect an abnormal condition of the lungs better by means of the fluorescent screen than by means of the photograph. The screen is a readier and more certain test."

The first important step toward accuracy in lung diagnosis was the devising of means for obtaining exposures of short duration. A wonderful advance was achieved when a lung roentgenogram was made in ten to twenty seconds, while the patient held his breath, but exposures of one second or less marked the real beginning of accurate lung diagnosis. Ziemssen and Rieder in 1901[2] published roentgenograms of the lungs made by means of intensifying screens in one second. In 1902, Hulst[3] showed the first lung roentgenograms made in America in one second without the aid of intensifying screens. Development of apparatus and tubes and refinement in technic have given every roentgenologist of the present day the means of making his chest exposures in a second or less, and this is absolutely essential for accurate work. Strange to relate there are men at this time who are not only attempting to make diagnoses of pulmonary tuberculosis by fluoroscopy alone, but also advocating this as the method of choice, but no one in this day who is familiar with the difficulties encountered in accurate diagnosis can countenance this as a safe routine procedure. It is not our wish to belittle the importance of fluoroscopy in the least, for it has its place and is of distinct value as a

[1] "The Roentgen Rays in Medicine and Surgery," 3rd Edition, 1903.

[2] "Die Roentgenographie in der innern Medicin, 1901."

[3] *Transactions American Roentgen Ray Society*, 1908, p. 223.

part of the examination of the lung, just as has inspection in clinical diagnosis. The single flat plate will serve for diagnosis in some instances, but neither is it alone an accurate or safe routine procedure, and we cannot conceive of anyone becoming so expert as to make accurate diagnoses routinely from flat plates, even though they frequently have their place. Stereoroentgenograms are absolutely essential in all instances, and preferably two sets, one made postero-anteriorly and the other antero-posteriorly.

FIG. 1. PATIENT SAID TO HAVE HAD PULMONARY TUBERCULOSIS FOR FIVE MONTHS, BUT PROBABLY MUCH LONGER.

Clinical examination showed consolidation of the left upper lobe and cavity. Roentgenoscopic examination: Very restricted diaphragm movements. Decided density left side. Stereoroentgenograms: Left lung: Consolidation with large cavities above third rib and general infiltration with conglomerate tubercles and small consolidations throughout the remainder of this lung. Right lung: Diffuse infiltration throughout entire lung, with individual and conglomerate tubercles.

After the establishment of the practically instantaneous exposure, the next important step to follow was the recognition of some essential characteristic feature of the tuberculous lesion. Fortunately the structure of the lung is such that exceedingly slight changes in density can be recognized by their contrast with the air containing lung tissue. Cole[1] was the first, in this country at least, to insist upon the recognition of the earliest visible manifestation of the tuberculous lesion in the roentgenogram,—the individual tubercle. By this term he did not infer the pathological entity as first formed and barely visible to the naked eye, but a tuberculous deposit of sufficient size to be easily visible on section of the lung. Such spots he described as individual tubercles, and still larger areas he called conglomerate tubercles. He insisted that these shadows found in numbers either in the parenchyma or grouped along the bronchial tree shadows were indicative of tuberculosis. Next in size to the conglomerate tubercles would be shadows denoting small areas of consolidation. (Fig. 1.) The term miliary tubercles is one that is frequently misapplied to these small spots and should not be employed, even in a general pulmonary infiltration, as it is misleading and does not correspond to clinical and pathological conceptions of the disease.

While it has aroused much criticism, Cole's classification has stood the test of time from the roentgenologic standpoint, and the individual tubercles he described, when multiple, of course, are generally accepted as comprising the earliest evidence of pulmonary tuberculosis that can be detected accurately by roentgenologic means. That their appearance usually means tuberculosis is probable, but that they invariably indicate the disease, even in the usual distribution of tuberculous lesions, we question. Dunham has attempted to carry the early diagnosis back a step further and to make a diagnosis before the definite spots of tubercle formation can be detected. He has described the typical appearance of the earlier state as practically a hazy fan-shaped area in the parenchyma at the terminations of the branching lines of a bronchial trunk shadow, usually the vertebral or the first or the second interspace trunks. He has

[1] *Transactions American Roentgen Ray Society*, 1908, p. 230.

ascribed this appearance to the result of congestion and exudation arising from the presence of the early tuberculous process. A diagnosis at such a stage would be exceedingly desirable, but we believe that such an appearance is not typical of tuberculosis and that it would be unwise and unsafe to base a diagnosis upon it. A beginning pneumonic process might bear a close and indistinguishable resemblance to it.

Roentgenologists are now fairly well agreed that early pulmonary tuberculosis may manifest itself in three ways, depending upon the anatomical distribution of the disease,—the hilus lesion, peribronchial infiltration along the larger subdivisions of the bronchial tree, and infiltration in the parenchyma around the bronchioles and their terminations. In addition there are certain end results that may be recognized, such as consolidation, cavity formation, bronchiectasis, fibrosis and calcifications, and certain complicating conditions, mainly in the pleural cavity, as empyema and pneumothorax.

Hilus Lesions.—In hilus lesions, physical signs may be indefinite or lacking in any features indicative of the presence of the disease or its location. If such a lesion exists, the roentgenogram may show an increase in the hilus shadow on one side or possibly both, either more or less homogeneous throughout, or with suggestions of glandular enlargements added. There is nothing typical in such an appearance, and it may arise from other conditions, be due to dust inhalations or be found in apparently healthy individuals. The roentgenogram has its value in the hilus lesion although a positive etiological diagnosis cannot be based upon the appearance presented. The etiological diagnosis must, if possible, be based primarily upon the clinical aspect of the case, and the roentgenogram then serves to indicate a hilus lesion and to show its extent, in the absence of manifestations elsewhere. (Fig. 2.) For example, given a case exhibiting the general symptom complex of tuberculosis—cough, slight temperature, slightly elevated pulse rate, and poor circulation in a patient under weight and with or without the organisms in the sputum, and presenting indefinite physical signs or none at all, if the roentgenogram suggests a definite hilus lesion and no manifestations elsewhere, it serves as confirmatory evidence, and as such, reveals the seat and extent of the lesion. In such a case the clinical aspect must determine the policy of treatment.

Peribronchial Infiltration.—This term is used to designate an infiltration along the larger subdivisions of the bronchial tree, and in accordance with the usual early distribution of the disease, the suggestive appearances would be found in connection with the upper secondary bronchi and their branches. The usual roentgen manifestations are a thickening of a bronchial trunk shadow extending upward from the hilus toward the extreme apex or outward between the shadows of the anterior portions of the first and second or the second and third ribs, with possibly, in

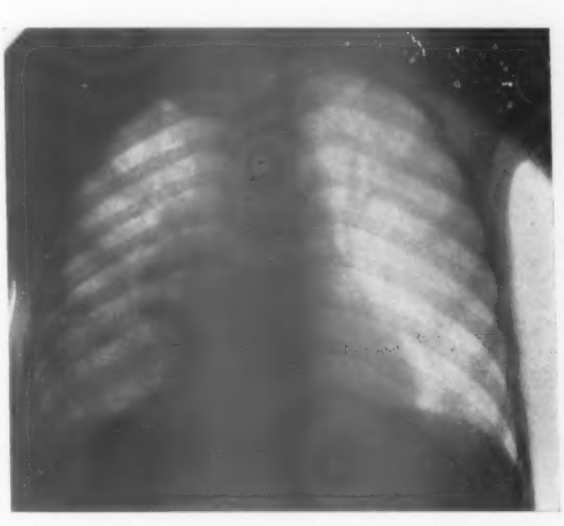

FIG. 2. PATIENT, MALE, AGED EIGHT YEARS.

Clinical evidence of tuberculosis by physical signs supposedly obscured because of previous right sided effusion which had been aspirated. Positive Von Pirquet. Roentgenoscopic examination: Adhesions right diaphragm. Stereoroentgenograms: Hilus lesion right side and thickened pleura at base. Note that the apex is clear.

plates presenting unusually rich detail, some fine mottling of visible tubercle shadows in addition. (Fig. 3.) That such lesions can be demonstrated by the roentgenogram there can be no doubt, but it is manifestly unwise to base an etiological diagnosis solely upon an appearance such as has been described for the reason that isolated thickened bronchial tree shadows in the upper branches are extremely common in the chests of healthy individuals working in inorganic and coal dust, and following whooping cough and influenza. Fine mottling along the thickened trunk shadow is, of course, more significant but is not necessarily pathognomonic. Given, however, a case clinically suspicious because of cough, malaise, evening temperature, slightly elevated pulse rate, poor circulation and loss of weight, with or without organisms in the sputum and the latter perhaps occasionally blood-tinged, but presenting indefinite or questionable signs over a certain area: if the roentgenogram shows such an appearance as has been described, and without any other manifestations, we believe that this appearance can *usually* be regarded as indicating the location, extent and character of the lesion (Fig. 4). But there are exceptions, and without tubercle bacilli the roengenographic appearance cannot *per se* be regarded as *indubitable evidence* of a tuberculous etiology. As an added value, the roentgenogram may indicate, in the presence of positive clinical evidence of no great severity that the patient is not necessarily in a dangerous condition, so that if, for financial reasons, a change of climate cannot be indulged in, there is still hope in fresh air at home, with suitable exercise, occupation, proper feeding and bathing. If on the other hand, however, the plates demonstrate typical lesions of greater extent and severity than the clinical aspect of the case would seem to indicate, then a more radical course may become imperative.

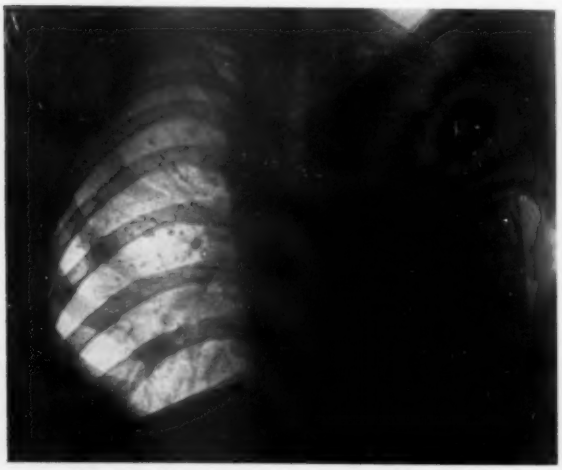

FIG. 3. CASE OF OLD EMPYEMA LEFT CHEST WITH GREATLY THICKENED PLEURA.

Roentgenoscopic examinations: Absence of expansion and diaphragmatic movement on left side. Spine concave to left and heart, vessels and trachea displaced. Stereoroentgenograms: Numerous calcified spots in the right lung. In the first interspace they are arranged to surround a somewhat dilated bronchus.

FIG. 4. PERIBRONCHIAL INFILTRATIONS. RIGHT APEX.

Clinical aspect: Cough, slight evening temperature, slight increase in pulse rate, loss of weight, and occasional blood-tinged sputum. No bacilli found in sputum. A few râles heard over the right apex. Stereoroentgenograms: No evidence of infiltration in parenchyma. Thickened vertebral trunks right apex.

Lesions in the Parenchyma.—This term implies the presence of shadows of visible tubercles in the regions of the bronchioles and their terminations where the shadows indicating bronchial trunks have ceased or have become fine lines. This is the only

type of lesion that can be regarded as presenting a typical roentgen appearance. Although we believe that it is indicative of a tuberculous lesion in most instances, we must recognize exceptions, and this being the case, the roentgenologist who bases an etiological diagnosis solely upon this appearance will undoubtedly make serious mistakes before his enthusiasm is curbed by a safe conservatism based upon experience and a comprehensive knowledge

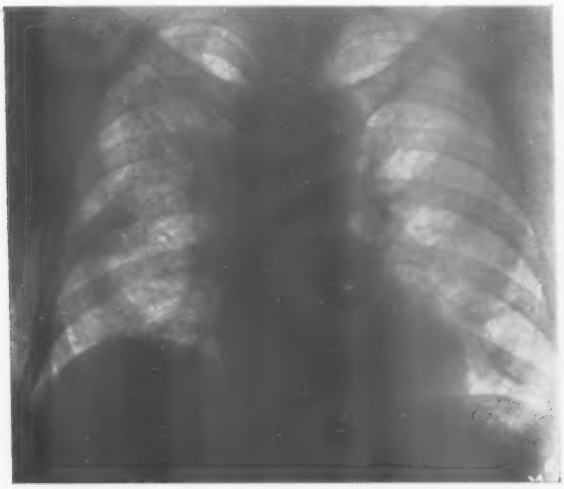

FIG. 5. CHEST OF COAL MINER WHO WORKED THIRTY-EIGHT YEARS *Outside* THE MINES.

Roentgenoscopic examination: No interference with diaphragm excursion. Stereoroentgenograms: Diffuse pneumoconiosis, with discrete spots, distributed from bases to apices. Fibrosis is just beginning in the right apex. There were no unusual chest symptoms. (Compare with Fig. 10.)

of pathology. The small shadows indicative of visible tubercles may be simulated by inorganic and coal dust inhalations, blastomycosis and other mycotic infections. Usually the distribution of these shadows will serve to distinguish tuberculosis from other causes such as dust inhalations, but not always. On the other hand tuberculous lesions may be generalized just as are the deposits in pneumoconiosis, but where such a widespread distribution exists there is always evidence of other lesions such as consolidations and cavities, provided the case is of comparatively long standing and not of short duration as in miliary tuberculosis. (Fig. 5.) In view of all these facts, is it safe and justifiable to base an etiological diagnosis upon the roentgenogram alone in this type of case, in the absence of or irrespective of clinical evidence of the disease? This question may be answered in various ways. In a general way, we are inclined to the opinion that such a procedure may be safe in a few instances, but it is certainly not justifiable routinely.

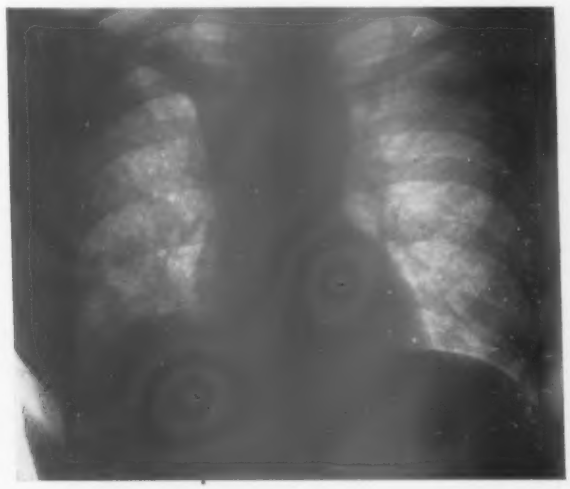

FIG. 6. A CASE OF OLD ADVANCED AND CHRONIC PULMONARY TUBERCULOSIS WITH PROBABLY A RECENT FRESH OUTBREAK.

The condition must have existed for a long period without recognition. When first seen by physician six months before she is said to have presented a typical history and signs of acute bronchitis, and one month later, symptoms of acute asthma. She then had a cough but not much sputum and had lost weight. On her return from a western trip at the end of six months, she gave a typical symptom complex of pulmonary tuberculosis with typical signs on the right side and positive sputum. Stereoroentgenograms: Pulmonary tuberculosis involving entire right lung, with evidence of infiltration throughout. The density would suggest an old or chronic process and most of it quiescent, with fibrosis. We cannot determine just how much is recent, but probably in the first interspace and extreme apex. A dense band of connective tissue extends from hilus to apex, probably a part of an old consolidation, and dragging on the vessels. Thickened pleura at base. (Three months later had gained twenty-nine pounds and was said to present no clinical evidence of disease.)

This answer must be modified, however, to suit certain undesirable conditions, based upon the unfortunate fact that while all men engaged in roentgenologic work and all physicians are able to

examine chests, they are not all capable of rendering dependable diagnoses. (Fig. 6.) When both are masters of their respective arts, the best interests of the patient are served. The roentgen examination is considerably enhanced in value and fewer mistakes will be made if the experienced roentgenologist checks up the work of the mediocre clinician, while the unskilled roentgenologist is of no service whatever to the expert clinician. We have observed numerous instances of the results of the

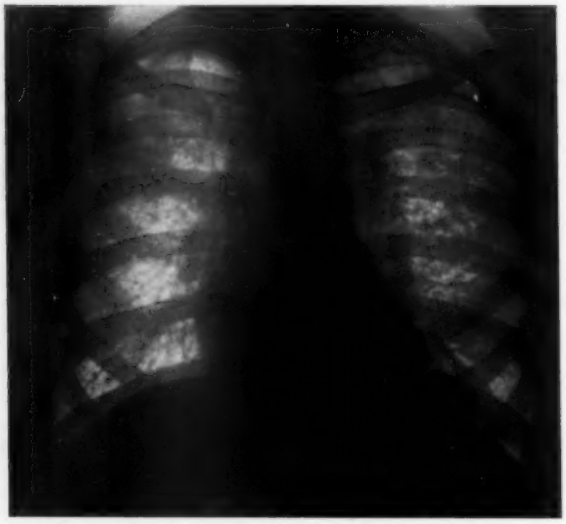

FIG. 7. CASE OF A STUDENT WHO WAS SAID TO HAVE A HEALED PULMONARY TUBERCULOSIS AFTER HAVING BEEN IN CALIFORNIA UNDER TREATMENT FOR TWO YEARS.

Stereoroentgenograms: Lesion at right apex and entire upper left lobe, with a recent appearance, but the patient presents no symptoms.

labors of both of these combinations, and we believe that much of the disagreement between clinicians and roentgenologists is the result of hasty judgment by one group of the efficiency of certain members of the other.

We do not believe that the roentgen examination is necessary in every case of pulmonary tuberculosis, although such a routine procedure would be desirable, especially in institutional work. No one who has had recourse to efficient roentgen work can honestly refute any assistance from it. We believe the roentgen examination offers probably the greatest aid in the doubtful case with a cough, malaise, loss of weight, poor circulation, evening temperature and slightly accelerated pulse rate, and presenting indefinite or questionable physical signs, but with no organisms in the sputum. If the roentgenogram indicates fairly typical evidence of a tuberculous lesion, it is reasonably safe to base a positive diagnosis upon it. In cases with cough and tubercle bacilli in the sputum but with indefinite or questionable physical signs the roentgenogram is again an efficient means of locating the lesion and showing its extent.

Activity.—Cole has divided the activity of lesions as indicated by the roentgenogram into three stages,—cellular, fibrous and calcific. This classification from the pathological standpoint implies active lesions, those in which the area is undergoing fibrous change or becoming encapsulated, and the final stage of a healed area—calcification. From the roentgenologic standpoint it implies primarily the determination of activity by differences in shadow density and there must be objections to such a classification. The marked difference between the active lesion and the calcified one is readily determined, but that between the new active lesion or tubercle and one with some fibrous change or between one with some fibrous tissue change and one completely fibrosed is difficult, and involves a certain personal equation, and we doubt that such observations can be made uniformly and accurately. (Fig. 7.) Certainly it does not seem to be a safe teaching that activity can be definitely determined by the roentgenogram. Furthermore, active and quiescent lesions are frequently coexistent. We do believe, however, that chronicity can frequently be determined by the amount of fibrosis present. In the long run, activity must be determined clinically.

Fibrosis.—This is one of the end results that harbors numerous sources of error. It is not a condition peculiar to tubercu-

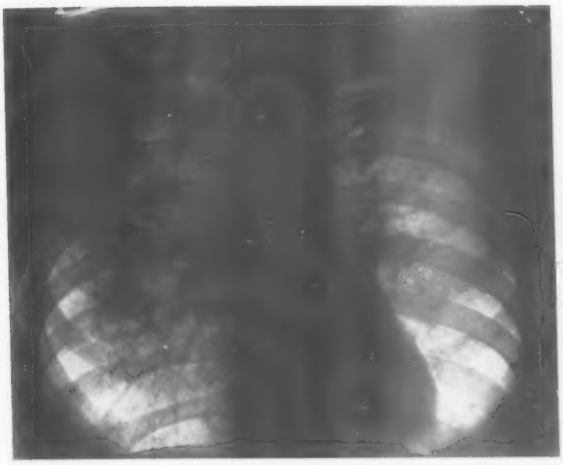

FIG. 8. OLD HEALED PULMONARY TUBERCULOSIS INVOLVING RIGHT LUNG, WITH RESULTING FIBROSIS.

Large bronchiectatic cavities previously found are now irregular in shape. The left lung is the seat of a more recent process now healed clinically.

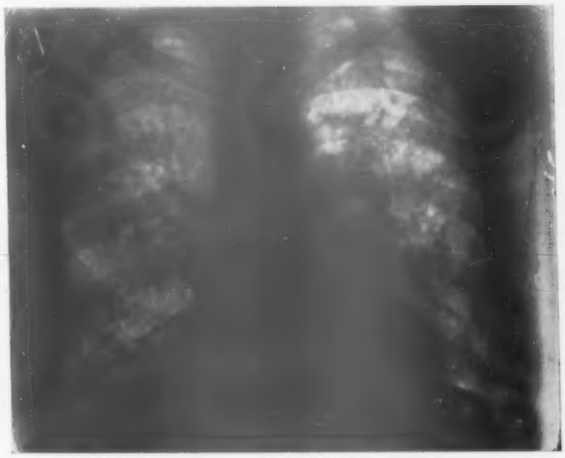

FIG. 9. CHEST OF A MALE AGED TWENTY-NINE WHO, WHEN A CHILD, INHALED A VEGETABLE BURR.

The appearance shown is that of an extreme fibrosis which prolonged clinical study has proved not to be tubercular in origin. In the right base are numerous bronchiectatic cavities, which under the fluoroscope, could be seen opening on inspiration and collapsing on expiration.

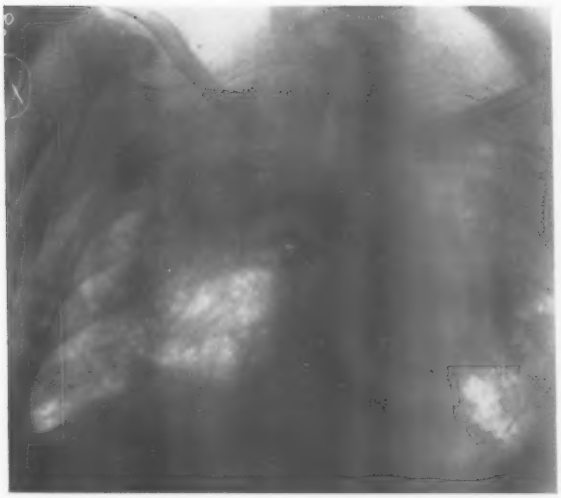

FIG. 10. EXTREME FIBROSIS IN THE CHEST OF A COAL MINER WHO HAD WORKED *Inside* A MINE FOR 30 YEARS.

Steroroentgenograms showed bronchiectasis and the fluoroscope showed no diaphragm movement. Repeated sputum examinations negative. (Compare with Fig. 5.)

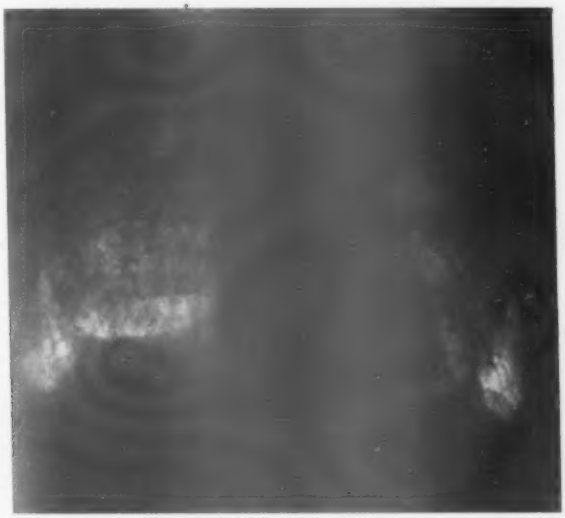

FIG. 11. PATIENT SUFFERING FROM SO-CALLED "POTTERS' ASTHMA."

Had worked in pottery for 45 years. Extreme fibrosis, bronchiectasis, and absolute fixation of diaphragm. Very marked dyspnea. He had previously been sent to a tuberculosis sanitarium but was discharged because of negative sputum. Eight repeated sputum examinations since the roentgen studies were also negative.

losis, but may follow many other pathological or semi-pathological processes. In order to determine that an appearance of fibrosis is of tuberculous origin, one must prove an antecedent tuberculous history or be able to demonstrate the typical appearances usually indicative of a tuberculous process along with the evidences of fibrosis. (Figs. 8 and 9.) In coöperation with Drs. Landis and Miller, we have had the opportunity of studying numerous cases of fibrosis resulting from long continued dust inhalation, and in many of these cases a diagnosis of tuberculosis had been made clinically at some time, but subsequent events have disproved this. In these same individuals a roentgen diagnosis of tuberculosis would no doubt have been unreservedly made had it not been for the experience our studies afforded. (Figs. 10 and 11.) The borderline cases in which fibroid changes are just beginning as a result of continued catarrhal irritation, are especially deceptive. The changes are most marked *in appearance* in the apical regions where tuberculous lesions predominate, and the resemblance is close. As the areas become more fibrosed the resemblance becomes more close. In industrial fibrosis the fibrous change is usually more apt to appear in the bases as bands or thickened trunk shadows than in the fibrosis of tubercular origin. This distribution seems unusual in view of the fact that the discrete spots due to pneumoconiosis are almost invariably distributed evenly from base to apex. The clinician or the roentgenologist who is always expectant of tuberculous cases is one who is always likely to be misled, and especially if he be a sanitarium man. Our experience has taught us that an occupational history is as important as a tuberculous one in a case of fibrosis. The effect of fibrosis upon diaphragmatic movements and its potentiality in dyspnea have been points of unusual interest in our studies of this condition.

In conclusion, we have endeavored to present this subject from a conservative standpoint, but with the realization that the roentgen diagnosis of pulmonary tuberculosis is a most valuable asset to accurate clinical diagnosis. We believe that the best interests of many tubercular patients are served by the combined endeavors of competent clinicians and roentgenologists working in unison.

THE ROENTGEN DIAGNOSIS OF POLYPI OF THE MAXILLARY SINUSES

BY CHARLES A. WATERS, M.D. AND HOWARD P. DOUB, M.D.

From the Department of Roentgenology of the Johns Hopkins Hospital

BALTIMORE, MD.

OWING to the frequency with which small round shadows with well defined outlines are encountered in the maxillary sinuses, we thought it might be of interest to inquire into their significance.

In the last three years we have made roentgen examinations of the paranasal sinuses in about 2,500 cases, and of this number there are at least thirty-six cases which show these well defined shadows in the antra. The majority of them have been found in the routine roentgen examination to which the Ward and Dispensary cases are subjected, and many of them left the hospital without the diagnosis having been confirmed by operation.

The method used in the roentgen examination is that described by Waters and Waldron,[1] by which the maxillary sinuses appear much clearer with the additional advantage of requiring but one plate.

In order to understand more clearly

[1] *American Journal of Roentgenology*, Feb. 1, 1915.

FIG. 1.

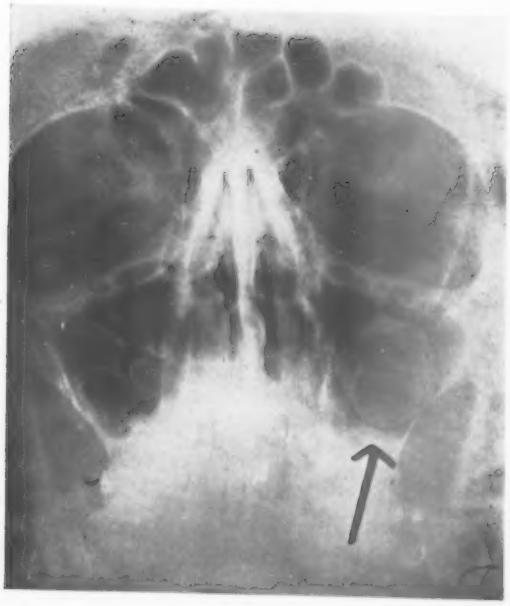

FIG. 2. CASE 3.

FIG. 3.

FIG. 4.

FIG. 5.

their significance and possible relationship to focal infection as well as to symptoms, we have tabulated the thirty-six cases according to their complaints, symptoms, clinical diagnosis, surgical pathology and associated nasopharyngeal conditions. Only seven have been completely studied from all five standpoints, the remaining cases not having been gone into sufficiently to admit of a positive diagnosis. They have consequently been omitted. In a large number of cases with well defined shadows and no symptoms, a mucocele containing clear straw-colored fluid had been found at operation.

From the roentgenogram a differential interpretation of the shadows cast by polypi and mucoceles can not be made; however, polypi are more apt to have associated inflammation of the mucous membrane lining the antrum, which would consequently produce a certain amount of clouding of the remaining portion of the antrum.

A summary of seven cases will show that they occur at all ages, the youngest being twelve years, while the others reach as high as sixty. Two cases occurred in medical students.

Summary.—Four patients complained of headache and nasal discharges, one complained of morning expectoration, while another complained of noises in the head. Two showed definite infectious arthritis.

Polyps were found at operation in Cases 1, 3, 4, 5 and 6; mucoceles in 2 and 7.

Bacteriological examinations were made in two cases with the result that staphylococcus aureus was found in Case 6, while no growth could be demonstrated in Case 5. The nasopharynx showed only minor changes which were probably not incident to the sinus condition. In one case the cervical glands were enlarged, which was accounted for by caries of the teeth and cryptic tonsils. In the remaining cases no associated pathological condition was found in the teeth or tonsils. In all cases except one there was some nasal obstruction and hypertrophy of the turbinates. On transillumination of five cases, the affected side appeared darker in four.

A STANDARD TINTOMETER FOR SABOURAUD'S PASTILLES

BY DUDLEY CORBETT, M.A., M.D. OXON., M.R.C.P. LONDON

LONDON, ENGLAND

IT is generally agreed that the methods at present available for measuring the dosage of roentgen rays are unsatisfactory. We have Kienboeck's method which, while accurate, is cumbersome, and methods which depend upon the color change of barium platinocyanide pastilles. Different instruments have been devised to fix permanent standard tints for these changes. There are the well known methods of Sabouraud, Bordier, Holzknecht, and Hampson.

They all possess one common disadvantage, namely, that it is extremely difficult to provide a standard that will match the pastille exactly, its texture and that of the varnished pastille being different. Furthermore, the source of light under which the comparison is to be made is not always specified as exactly as one could wish. This, as will be shown later, is a matter of considerable importance.

These pastilles, though very convenient, are unsatisfactory in three ways: (1) they are unstable and liable to change color in a warm climate; (2) they are only accurate with rays of medium penetration; and (3), when used to indicate a dose of filtered rays, the relation between any given tint and the effect on the skin is lost, and an "erythema dose" indicated by the pastille will not be followed by an erythema of the skin. Nevertheless, they are the only convenient method we possess, and within cer-

tain limits a considerable measure of accuracy is possible when doses of unfiltered rays are given for epilation. There should, however, be a reliable standard tint or tints. An ideal standard would be one that does not fade, keeps clean, matches any given tint exactly and can be repeated in any quantity without variation.

I have had no experience with Bordier's or Holzknecht's instruments and never could read Hampson's satisfactorily. It was also noted that, although one was fortunate in obtaining a tint B on Sabouraud's card giving epilation without marked erythema, yet tints on different cards varied considerably, some of them representing a dose which, if given, would endanger the regrowth of the hair. Even with a good standard, comparison was difficult and when the new therapeutic roentgen department at St. Thomas's Hospital was opened, we were constantly having trouble with the epilation of scalps for ringworm, many cases needing a second exposure before all the hair was removed. Since the introduction of the radiometer, which is the subject of this paper, about 500 cases have been treated and of those only one has needed a second sitting. In fact, in microsporon injections one can guarantee that the child can safely return to school within 5 weeks of the day of exposure. The megalosporon tineas which form a small percentage of our cases may need a longer period of isolation to allow the inflammatory infiltration of the scalp to subside.

In view of this original difficulty a series of experiments were carried out with the hope of fixing a permanent standard for tint B. They are fully described elsewhere but the principle was to measure the color changes of the pastille directly after exposure to roentgen rays by means of a Lovibond's Tintometer. The standard tints of this instrument consist of three series of glass transparencies, dyed red, blue and yellow, each series being very finely graded and standardized. In a suitable viewing box these can be so combined as to match by transmitted light against a white background the color sensation transmitted by reflected light from any given substance. They are used as standards throughout the world for various manufactured products, dyes and so forth.

An understanding of the methods by which the standard tints for the pastille were obtained and the manner in which it changes color are of some assistance in the use of the radiometer which was subsequently devised. A brief summary of the steps taken is therefore given. Two constant sources of light were used, diffused daylight on the one hand, and on the other the light of an 8 c.p. carbon filament electric lamp with frosted glass. Quite different color standards were needed in the two cases. The average of a large number of observations gave the color composition of a tint B, which always succeeded in producing epilation with but a transient erythema at about the sixteenth to eighteenth day on actual cases of tinea of the scalp.

The tinted glasses necessary to produce this color were noted and one thus obtained unvarying standards for the B dose both by daylight and electric light. It was then an easy matter to measure the color of any fractional or multiple dose up to 2 B and to make the corresponding standard needed.

It was found that in both cases the color change is one from green yellow to orange yellow. A pastille appears to be much more green under daylight and it must be turned to nearly 1/2 B before it loses its green constituent. On the other hand, under electric light there is little green in the unexposed pastille which is soon lost. In both cases, after the green has gone, the color change is a gradually increasing orange, brought about by an increase in its red constituent. Therefore, in making the color comparison between pastille and standard in the region of the B dose one must ask oneself which of the two appears to have more red.

THE EPILATION DOSE.—It was considered advisable to retain the symbol "B" as representing the epilation dose rather

than to add to those already existing. It was found, however, that 4/5 B will nearly always epilate, indeed I always employ this dose for epilation in ringworm except for the top area which receives the full B dose, this region usually needing a more generous exposure. If one is using old pastilles that have been bleached two or three times it is better to give a shade over 4/5, say 9/10 B. For the epilation of stiff beards the full B dose is needed, but it is worth noting that where there is much inflammation present, as in sycosis, the interposition of a thin filter of 0.25 mm aluminum above the pastille will mollify the ensuing reaction. In young children 4/5 B is ample to produce epilation all over the scalp. The dose of 1/2 B was given once or twice to the scalp in the experimental work and an erythema, followed by a transient mild dermatitis, resulted. The regrowth of hair, though slower than after the smaller doses, was satisfactory, but this point must be regarded as the limit of safety for epilation with unfiltered rays. Standards were made for the smaller doses 1/4 B, 1/3 B, and 1/2 B, for the convenience of those who measure with the pastille on the skin and so forth, and standards can easily be provided for any fractional or multiple dose up to 2 B.

FIG. 1. THE TINTOMETER.

FIG. 2. THE TINTOMETER IN USE.

DESCRIPTION AND METHOD OF USE OF ORIGINAL INSTRUMENT.—Various technical improvements are now being made on the original design although the principle remains the same. The apparatus hitherto on the market consists of an optical instrument or viewing box provided at one end with an eyepiece and at the other perforated with two small holes. At the distal end of the box are frames provided for the insertion of the glass standards, that on the right for the matching tints, and that on the left for the neutral tints if required, as will be explained later. An extension from the back of the instrument carries the support for the background, which is made of standard white paper *which must always be used* and changed when it gets dirty.

In the metal support of the background and in the extension holes are cut through which the pastille holder can be passed.[1]

The choice of daylight or artificial light is a personal matter, but the following precautions should be observed: In daylight work in a diffused white light, avoid shadows and yellow light of any kind. With electric light use an 8 candle power carbon filament lamp with frosted glass and a suitable black shade so arranged that the background is 8 inches from the lamp. The lamp should be discarded as soon as the light becomes yellow from prolonged use.

[1] It is impossible to provide for every shape of pastille holder: to ensure convenience it is best to send the dimensions of the actual pastille holder or a model to the makers so that it may be properly fitted, for it is a great convenience to examine the pastille in its holder.

As a preliminary experiment, fix the instrument upright in its stand, facing the light. Take a white background and arrange it so that on looking down the eyepiece two white circles are seen. Some of the background slips are perforated for the pastille holder; if so, the slip will need reversing. Put in the frames provided, on the one side say a 1 B standard and on the other a 4/5 B standard and see if you can readily appreciate the difference between the tints. Try the other standards in a similar manner and accustom yourself to the color scale.

Having acquired this experience one is in a position to use the instrument with the pastille. The right hand frame is for the matching tints, the left need not be considered for the moment. Supposing we wish to give a full B dose. Put in the right hand frame a 4/5 B standard and expose the pastille at a point half-way between anticathode and skin for such a time as according to previous experience with the tube would produce a dose rather less than 4/5 B. A tube of unknown efficiency should never be used, of course, to give an epilation dose with unscreened rays. At the end of the time switch off the current, remove pastille holder and examine the pastille in the instrument. Whatever the shape of the holder, arrangements must be made so that the pastille under examination lies practically in the same plane as the background. If by some unusual construction of the holder this is impossible, the pastille must be removed from its holder and placed on the background. In either case it is important to adjust the pastille so that none of the unirradiated green portion is visible through the left hand aperture. One then looks down the eyepiece and sees on the left hand the orange color of the pastille by reflected light and on the right the orange color of the standard glass by light transmitted from the white background. In this way the comparison is made. Let us suppose we measure the color of the pastille as exactly 4/5 B. It is then easy to calculate how much more exposure is necessary to bring the pastille to the full B tint, other factors such as milliampere reading and vacuum of tube remaining constant. The necessary extra exposure is given and the final comparison made.

PRECAUTIONS.—These standards will be found to match the French Sabouraud pastilles exactly. There are, however, certain difficulties to be encountered and precautions taken.

1. *Halation.* If the pastille is very highly varnished it will reflect a lot of white light and make the reading more difficult. The varnishing is never constant and it is impossible to provide for every type.

This difficulty can be largely avoided:

(*a*) by moving the instrument further away from the source of light and so reducing its intensity;

(*b*) by altering the angle at which the light strikes the place of the pastille. This is effected either by altering the position of the lamp or by tilting the whole instrument slightly backward toward the observer.

2. *Neutral Tint.*—It was perhaps unfortunate that this little complication should have been introduced, but it was unavoidable if a perfect match of all the pastille changes was to be obtained. When measuring the unexposed pastille and the 1/4 and 1/3 B in bright daylight it was found that, although it was possible to match the pastille in tint, it was always brighter than standard. This brightness which is due to the white light reflected from the pastille varnish is dulled, if necessary, by the interposition of a standard neutral tint. This neutral tint standard is placed in the left hand frame so that it intervenes between the eye and the pastille, the standard tint being as usual in the right hand frame. But varnishes vary so much that the original standard neutral tints sent out may not be right for all pastilles. However, they are only needed for the smaller doses and can be dispensed with when electric light is used, so that the difficulty is not one of great importance.

3. *Pastilles.*—All the work was done on the French-made Sabouraud Pastille. In this country we have no difficulty in keeping pastilles for a considerable length of time so that for rough work a pastille can be used over and over again, if it is well bleached in bright daylight. Where very accurate doses are required, new pastilles should always be used. The exposed pastille never returns exactly to its original tint even after thorough bleaching. Yet this fact makes very little difference to the orange part of the curve—that is to say, tint B is not reached appreciably quicker for practical purposes provided that the pastille has not been used more than three times.

With a used pastille one would be inclined to expose to a tint nearer 1 B than 4/5 for epilation.

It should be remembered that the pastille fades quite rapidly under electric light as well as daylight, so that one should not be too long over making the comparison.

SUBSTITUTES FOR THE SABOURAUD PASTILLE.—The only substitute for the Sabouraud Pastille which has been brought to my notice is that made by Cox & Co. under the direction of Dr. Levy. This pastille varies from the Sabouraud in certain important respects, presenting alike advantages and disadvantages in comparison.

1. It can only be used for comparison under electric light; by daylight the colors are wrong.

2. It fades extremely slowly. The specimens I have examined took a week to fade from 1 B to 1/2 B and did not return to their original color after several weeks. This is an advantage in allowing greater leisure over the comparison, but a disadvantage in that (as far as my knowledge goes) they could not be used a second time with any reasonable accuracy.

3. It appears to correspond closely with the Sabouraud standards in the neighborhood of the 1 B dose.

4. The makers have brought out a radiometer for their special pastille which must only be used with the electric light as fitted. It is admirably turned out. The general principle is based upon my original instrument, transparent standards being employed. I have no knowledge as to how these are made, and it is very unfortunate that the Lovibond standards could not have been used in its construction, as it would then be technically perfect. I have no personal experience with it in actual practice.

SUMMARY

1. Experimental work has determined the exact color changes occurring in the Sabouraud pastille when exposed to roentgen rays, and has established a permanent standard for "Tint B."

2. Similar standards can be prepared of the correct tint for any fraction or multiple of this dose up to 2 B or 10 H, for use with daylight or electric light.

3. The standards can be readily and accurately reproduced, are easily kept clean and do not fade. They are manufactured by a firm whose experience in such work is unique and who have established similar color standards for other purposes which have been officially adopted in many industries.

4. The optical instrument itself greatly assists the color comparisons by cutting off extraneous light.

5. The practical error need never exceed 10% and as the B tint adopted allows a margin of 20% on either side of the mark in which epilation will take place without permanent alopecia when using rays of medium penetration, ample security is afforded.

6. Should any alteration take place in the composition of the Sabouraud pastille a new series of standards could easily be worked out.

The makers are Tintometer, Ltd., Crown Laboratories, Salisbury, England.

A CASE OF CARDIOSPASM RESEMBLING MALIGNANT STRICTURE OF THE ESOPHAGUS

BY JOHN S. DERR, M.D.

First Lieutenant, Medical Reserve Corps, U. S. Army.

ATLANTA, GA.

THE following case was referred to me for roentgen examination by Dr. G. W. Quillian, of Atlanta, to whom I am indebted for clinical history and physical examination, and who treated the case throughout its course.

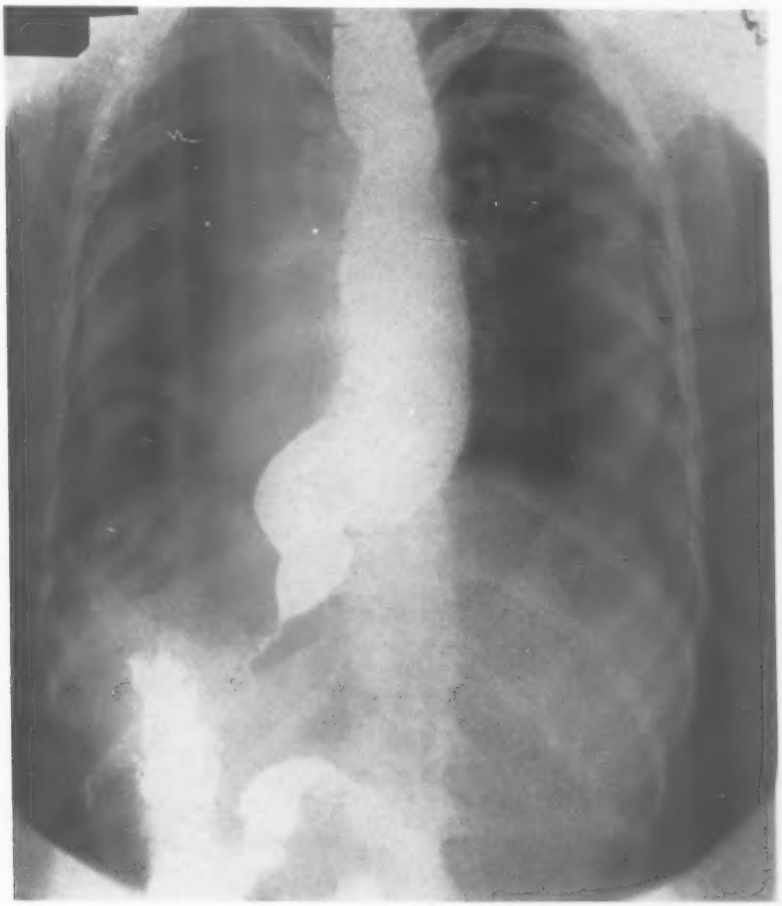

FIG. 1. ESOPHAGUS 45 MINUTES AFTER BARIUM MEAL AND FLUOROSCOPIC EXAMINATION

Clinical History.—The patient was a married woman, 35 years of age, with a distinctly cancerous family history, her great-grandmother, a grand-aunt, a grand-uncle and a second cousin having died of cancer of various organs. The patient had typhoid fever at the age of 14, and tonsilitis at 27. There are three healthy children between 14 and 10 years of age.

The complaint consists in inability to retain food, poor sleep, constipation, irregular menstruation, weakness from loss of blood, indigestion, regurgitation of food and a choking sensation which is intensi-

FIG. 2. SAME AS FIG. 1, LATERAL VIEW.

FIG. 3. TWENTY-TWO HOURS AFTER BARIUM MEAL, SHOWING RESIDUE IN ESOPHAGUS (X) AND STOMACH WELL FILLED.

fied during menstruation. There is a sensation of a heavy weight pressing on her chest, coupled with a feeling of strangulation, drowsiness and complete loss of energy at times.

Physical Examination.—Heart and lungs negative. Abdomen soft, with tenderness in the epigastric region on pressure. Cervix uteri eroded, reddened and congested. Fornices negative; body of uterus enlarged and tender.

FIG. 4. THIRTY MINUTE RESIDUE IN THE ESOPHAGUS, NINE WEEKS FROM FIRST EXAMINATION.

On these clinical findings a diagnosis was made of incipient carcinoma of the cervix, with nervous gastric disturbances from weakness, etc. The esophagus was thought to be negative, because the stomach tube was introduced without difficulty or resistance. Consequently, panhysterectomy was performed, following the usual preliminary anti-acidosis treatment. After a temporary improvement the strangling, choking condition returned, interfering with the ingestion of food and drink to such an extent that a postoperative

acidosis developed. Although the patient satisfactorily responded to treatment, the old symptoms reappeared, with inability to retain food, and loss of weight.

It was at this juncture that the patient was referred to me for roentgen examination. The plate revealed a constriction at the cardiac end of the esophagus. A suggestive diagnosis of carcinoma was made, stricture from typhoid fever or cardiospasm. Esophageal bougies were introduced without difficulty up to 42 French. At a second roentgen examination, which showed a slight improvement, a positive diagnosis of cardiospasm was made, and a Plummer's hydrostatic dilator brought about complete relief after three treatments.

Roentgen Examination. — Two ounces of barium sulphate in a glass of buttermilk were administered, and the esophagus was seen to dilate into a broad column and suddenly taper out to a blunt po'nt below the diaphragm. Forty-five minutes after this meal a roentgenogram (Fig. 1) was made in the prone position, and the stomach is shown emptying normally. The patient complained of difficulty of retention and discomfort.

FIG. 5. IMMEDIATELY AFTER FULL BARIUM MEAL, TWELVE WEEKS FROM FIRST EXAMINATION.

A lateral view at this stage of the proceedings is shown in Fig. 2.

Fig. 3 represents the condition 22 hours after the meal. It shows a residue in the esophagus, the vanguard of the meal having reached the cecum and ascending colon. The stomach is still moderately filled,

being fed from the esophagus. This convinced me that the case was one of organic stricture, probably malignant.

Fig. 4 shows the third examination made nine weeks later, after gradual dilatation with bougies had been practiced. There was some symptomatic improvement, but the plate still shows a large residue after thirty minutes and the esophagus nearly as large as at first.

Fig. 5 reproduces the roentgenogram made twelve weeks from the first examination, and after three treatments with the hydrostatic dilator had been given. The exposure was made almost immediately after taking two full glasses of barium and buttermilk. The esophagus is seen to be much smaller and its peristaltic waves can be distinctly made out. The location of the spasm is still present, but the rapidity with which it is passed by the meal is shown by the amount in the stomach. Within 15 minutes after taking the meal not a trace of barium remained in the esophagus, as was shown by the fluoroscope.

The patient is symptomatically well.

DR. HENRY E. WAITE

HENRY E. WAITE, M.D., one of three remaining charter members of the American Roentgen Ray Society, died at his country home at Bethel, Conn., on July 26, 1917, in his 72nd year. Dr. Waite was well known among the older members of the American Roentgen Ray Society. He was the founder of the Waite & Bartlett Manufacturing Company; a member of the American Medical Association, the American Electro - Therapeutic Associa - tion, Eclectic Medical Society, New York Electrical Society, Alma Lodge No. 728, F. & A. M., and he was also a 32nd Degree Mason. For seven years he was instructor and demonstrator of electro-therapeutic apparatus at the New York Post-Graduate Medical School. In 1879 he invented the Molecular Telephone which was the first instrument used for long distance telephone communications, the places being from New York, N. Y., to Cleveland, Ohio, over the Postal Telegraph wires. He was a veteran of the Civil War, having served three years with the 17th Regiment of Connecticut. He is survived by a wife and a son, Harry F. Waite, who is perhaps better known to many of the younger roentgenologists than his father. L. G. C.

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EDITORIALS

ROENTGENOLOGY—A SCIENCE

To the trained roentgenologist it seems at first sight little short of humiliating, if not insulting, to have the practical exercise of his profession likened to a commercial undertaking or a business, and is apt to dismiss what he considers an unmitigated slur with a contemptuous shrug of the shoulders.

This attitude would be perfectly justified but for two considerations.

The first is that renewed discussion of this subject has of late again engaged the attention of the medical and allied press, and the second is that the medical profession in general, and the roentgenologica branch thereof in particular, are to a large extent to blame not only for the origination but also for the perpetuation of so ludicrous a misconception.

The object of the present article, therefore, is to lay down clearly and distinctly the facts to be considered in the case: facts to be emphasized as placing roentgenology in the scientific realm where it belongs, and facts to be denounced as derogatory to its scientific character.

To the readers of this JOURNAL and to roentgenologists generally there is nothing new in the train of thoughts that underly the present arraignment, but it is of importance to them and their profession to have the salient features clearly in mind whenever and wherever the exercise and discussion of the roentgenological science and practice demands of them the adoption of an unmistakable attitude with a view to educating others whose knowledge, views and opinions have not undergone analysis, much less crystallization, and are therefore apt to be out of focus.

The germ of misconception as to the true nature of roentgenology arose when, in the dawn of the roentgen era, part of the medical profession set their teeth against acknowledging the new art as being of any serious importance either in diagnosis or treatment. Even at the present time this prejudice has not yet been entirely overcome. To do justice to the early doubters, it should certainly be admitted that the ability in the early days of the art to obtain certain shadows, and the inability to obtain others, could not impress the scientific mind as having any standard value, and this recognition administered the first blow to the scientific aspirations of roentgenology.

The second blow to its cause was administered by the avidity with which pseudo-scientists and quacks prostituted the art by endowing it with untenable claims and by working havoc in its application.

To the modern, fully trained roentgenologist, who is in most cases a qualified physician, it is unnecessary to dwell upon the successive stages of development which the application of the roentgen rays has undergone and is still actively undergoing. To him the question is definitely settled that a full knowledge and the pursuit of roentgenology is indeed a science in the broadest and most exacting sense of the word: a science not only serious and intricate but also of the highest importance for the service it is intended to render to humanity. But it is not those that know, but those that do not know, on whom these facts have to be impressed, and it is in this particular that the medical profession —both roentgenologists and non-roentgenologists—has failed to act up to the demands of the spirit of the times in the lofty conviction that the facts of scientific attainment may be left to speak for themselves. That again holds good for the educated few, but it does not hold good for the less educated multitude.

The very use of the term "*x*-ray" is conducive to the breeding of contempt. How can a patient have full confidence in the application of a process, the nature of which the physician himself admits he does not understand by describing it as "*x*," the unknown? That term has served its purpose when Roentgen, upon discovering the rays, gave a very full and lucid description of them, but modestly contented himself with admitting that he did not know what kind of rays they were. True, we do not know to this day; but we apply them every day in all parts of the civilized world to such an enormous extent that they are entitled to the dignity of the name that is their due, and that is roentgen rays. Every physician and the bulk of the educated laity understand the term, while the rest of the world would not understand the rays and their action any better by calling them *x* instead of roentgen rays.

It is an unbecoming slur upon his own profession, if the roentgenologist informs his patient that he is going to take an *x*-ray picture of him. What wonder if the patient thinks no better of a roentgenologist than of a photographer, taking a snapshot in the fraction of a second? There will be no necessity for going into scientific explanations to a patient as to why an anteroposterior, lateral or any other position must be selected, nor what voltage, amperage, focus-skin distance, filters, Holzknecht units, etc., are being employed. But he certainly ought to be informed that, after a careful study of his condition, the roentgenologist is going to make a roentgenogram of the affected part of his anatomy, and he ought to be duly impressed of the extreme importance of the proceeding.

Other points have been dwelt upon in the contributions to technical journals to which we have already referred. Most of them are borne of good intentions with the object of raising the dignity of applied roentgenology in the eyes of the public and even in those of the non-roentgenological part of the medical profession. Some of these points may here be touched upon as showing that it is possible to go too far even with the best of intentions.

Thus, a greater value has been attached by some authors to roentgenograms, made for purposes of diagnosis, which corroborate the history, symptoms, clinical findings, etc., than to those that contradict them. But while the value of confirmatory roentgen evidence is unquestioned, negative roentgen findings may be of even greater importance. Indeed, the very value of a roentgen examination may under certain circumstances lie in the fact of its contradicting the history or the clinical findings. We recently reported a case in these pages where the blade of a large knife was roentgenologically discovered in the skull of a patient who attrib-

uted the cause of his head trouble to a fall from a tree and stoutly denied the occurrence of a murderous affray in which he possibly wielded a similar weapon with fatal effect. The roentgenological value of confirmatory evidence is unquestioned, but the number of pathological cases where clinical investigation failed to discover the causative factor or gave rise to mistaken diagnoses, and where it was left for the roentgen examination to clear the condition up, are too numerous to allow the statement to pass unchallenged that roentgenograms are of no value unless they confirm the history, symptoms and clinical findings.

Another demand made for the purpose of raising the scientific status of the roentgenologist is that roentgen examinations and treatments should be performed only by regularly qualified medical men.

While the directions for examination and treatment should unquestionably be given by a duly qualified physician in the majority of cases, there is no reason whatever why he should perform the act, i.e. the mechanical part of the examination, himself. The treatment, as prescribed by the physician, may be and generally is given by a trained assistant, and the fluoroscopic or roentgenographic "picture" may be produced by anybody totally devoid of medical or anatomical knowledge. It is by mixing up the scientific and mechanical parts of the art that the physician stands in jeopardy of being classed as a photographer, a man who takes your picture and makes a charge for it. Let it be understood that the taking of a picture does not amount to making a diagnosis, nor the turning of a switch to the destruction of a tumor. It is the brain of the roentgenological physician, the science he brings to bear on the case in discovering pathological conditions from the presence or absence of shadows, and particularly in interpreting the meaning of the roentgenogram, that constitutes his art, and not the mechanical performance of taking a picture.

This phase of the discussion brings up the question whether patients should be given copies of the "pictures" taken. It is pretty generally agreed they should not as tending to create a wrong conception in the patient's mind of the nature and value of the roentgenologist's art. This refers most emphatically to roentgenograms of internal organs, etc., which by their very nature could not be of any earthly use or benefit to the patient. There may be exceptional cases, however, such as the location of a foreign body, where no harm could come from presenting a patient with a copy of the successful roentgenogram, much in the same way as a surgeon might present him with the extracted bullet.

Dental roentgenologists bitterly complain of similar conditions in their own specialty, and possibly their grievance is even more justified inasmuch as to an outsider the "taking of a picture of the teeth" does not seem to require any dental knowledge, and a recent editorial in the *International Journal of Orthodontia* takes great pains in pointing out the fallacy of such assumption and fully substantiating the dental roentgenologist's claim to scientific attainment.

In addition to this, the dental roentgenologists have another grievance of an exactly opposite character, and this consists in the complaint that physicians who are roentgenologists but no dentists interfere with their profession by making dental roentgenograms. This is a matter for specialists to decide, but another editorial in *Dental Items of Interest* seems to be going too far in claiming that the mere "taking of a dental radiograph is practice of dentistry," to which, it is inferred, a mere roentgenologist is not entitled. If that were admitted, then the localization of a foreign body in the eye would amount to the practice of ophthalmology which it does not, although the location of the said body would require quite as much anatomical knowledge of the eye as the making of a dental roentgenogram requires of the anatomy and pathology of the teeth;

and there is no reason why a physician who has that knowledge and is at the same time a trained roentgenologist should not apply the art to the teeth as he does to the eyes or the intestines.

Localization

Journals dealing with roentgenology for some time past have devoted much space to localization. Some of the articles have described methods and devices seemingly accurate and possibly useful under normal office or hospital conditions, but which would be hopeless in the actual rush and strain of military service in time of war. Nearly all methods still bear the names of their authors, real or supposed, and are often judged more by reference to the name and fame of the advocate than by their real utility.

In order to make an intelligent choice of methods, it is essential to understand the conditions to be met in this work. The ordinary office or hospital practice has but little in common with wartime demands. When not simply tens but hundreds must be cared for, when a single foreign body in the patient is the unusual case, methods seemingly adequate in times of peace become woefully wasteful of time and effort. Speed and reasonable accuracy become prime considerations to which all else must be subordinated.

Those whose previous work has been far removed from accurate measurements are quite likely to be misled by a flavor of algebra, or an elaborately constructed measuring device.

The ideal methods may not be available, but it is our duty to scrutinize and test every offering with all possible care and then to select only those fulfilling as nearly as possible present needs. Any procedure worth considering must approach at least the following standards:

(1) The apparatus needed must be simple, have few parts and these not likely to be mislaid.

(2) Their operation should not involve reading fine scales, making numerical computations or drawing diagrams requiring fine measurement.

(3) The measurement of *small* lengths should not be required.

(4) The required manipulation of the patient should be a minimum.

(5) The delay incident to the development of a photographic plate or film must be avoided, except where need of a permanent record is imperative.

(6) A minimum number of steps in the process is essential both for speed and to avoid undue fatigue of the operator.

(7) Methods should, when desired, be capable of use at the operating table.

Clearly only the simplest *fluoroscope* methods can meet these tests and it is becoming evident that all but a *very small percentage* of foreign bodies can be localized in this way. The few in which roentgenograms are required should again be handled by the simplest methods. In testing out methods we must forget personal bias and study real operations. Can the proposed scheme give preoperative location to a *rational* (not an academic) degree of accuracy? Can an average man be trained to do it quickly? Only by patient study and by the merciless scrutiny of stop watch and test can these questions be answered.

J. S. S.

NOTICE

Following the precedent established last year, we are publishing in this issue the portrait of the President of the American Roentgen Ray Society, Major Lewis Gregory Cole.

The Eighteenth Annual Meeting of the American Roentgen Ray Society will be held at Waldorf–Astoria Hotel, New York, Sept. 20–22, 1917.

TRANSLATIONS & ABSTRACTS

NIEBER, OTTO. Roentgenological Studies on Ostitis Fibrosa Cystica. (*Fortschr. a. d. Geb. d. Roentgenstr.*, 1916, Vol. 23, No. 5. Ref. *Zentralbl. f. Roentgenstr.*, 1916, Nos. 5 and 6, p. 154.)

This is a report on eight cases of this affection. The roentgenogram is so characteristic that it is difficult to mistake it. The cysts have nearly always an oval or sometimes a spherical form. The margin is always sharply delineated against the healthy osseous tissue. There is no thickening of the osseous walls, while callus formation in possible spontaneous fractures is quite insignificant. The affection is observed in almost any part of the skeleton. The diagnosis could not once be made from the clinical pathological picture.

SHEN, S. J. Fibroma of Mediastinum. (*Boston Med. and Surg. Jour.*, Jan. 11, 1916, Vol. CLXXVI, p. 53.)

Even with the aid of the roentgen ray the differentiation of various tumors of the mediastinum is not always easy. This is illustrated by the following case of fibroma of the mediastinum reported from the Pathological Laboratory of the Peter Bent Brigham Hospital, Boston. Such a tumor is so rare that it has been considered a pathological curiosity. Hare found seven cases of so-called fibroma in five hundred cases of affections of the mediastinum. Probably not over five out of the seven cases were really benign fibroma.

The author of this article was able to find only eleven cases besides his own in the literature. The patient, a white man, fifty-one years of age, had complained of cough and dyspnea. Family history negative. Careful search for evidence of tuberculosis was negative. Wassermann test (blood serum) negative. Roentgenological examination showed a definite shadow extending a considerable distance beyond the normal shadow of the left auricle. The transverse diameter of the heart at this region, including the shadow, measured 11 cm. The ventricles were small in size and the posterior mediastinum was clear. By fluoroscopic examination, a definite pulsation, diastolic in time, was observed over the shadow beyond the region of the left auricle.

Seven months later the patient died of septicemia, the final infection being of the cheek. In the meantime several fluoroscopic observations had been made which showed that the mass in the region of the left auricle had not increased materially in size, except that the last examination, just prior to his death, showed the mass to be very much larger than when it was observed at the hospital. It did not move when the breath was held and no pulsation whatever was seen. At autopsy there was found in the anterior mediastinal space over the pericardium a tumor weighing 180 gms. Pathological diagnosis: Fibroma durum.

HAUBER, AMBERG. On Myositis Ossificans Traumatica Circumscripta. (*Muench. med. Wchnsch.*, 1916, No. 3. Ref. *Zentralbl. f. Roentgenstr.*, 1916, Nos. 5 and 6, p. 154.)

Report of two cases. In the first few weeks of the affection, the roentgenogram shows a so-called veil-shadow, *i.e.*, there are distinct light and dark shadows alternating. After the sixth week, this shadow is less broad, but more saturated. Disintegration is in preparation. Its accomplishment requires much time —months and often years. This shadow can be seen at the elbow flexure and in the femur above the patella.

SHELDON, R. F. A Study of the *X*-rays of Cases of Fracture of the Long Bones. (*Boston Med. and Surg. Jour.*, Jan. 11, 1916, Vol. CLXXVI, p. 53.)

A study of *x*-ray plates at the Massachusetts General Hospital was undertaken in order to determine the frequency of fractures and the line of fracture of the long bones.

The following table shows the seat of fracture in the 57 plates of fractures of the femur:

Head		1
Neck: Impacted	5	
Not impacted	5	10
Intertrochanteric		4
		15
Shaft: Upper one-third	4	
Middle one-third	31	
Lower one-third	7	42
Total		57

The study of the 405 plates of fracture of the tibia and fibula shows the seat of fracture to be as follows:

Upper end			
Tibia	8		
Fibula	1		
		9	
Shaft			
Both bones	94		or 23%
Tibia	32		or 7.9%
Tibia, tuberosity	2		
Fibula	1		
		129	
Malleoli or lower end			
Both bones	114		or 28%
Tibia	44		or 10.8%
Fibula	108		or 26.6%
		266,	or 65.4%
Multiple	1		
Total		405	

Of the 8 fractures of the upper end of the tibia, all entered the knee joint. The remaining case is a fracture of the upper end of the fibula, a rather unusual situation.

The 266 cases of fracture of the lower end of the tibia and fibula are best grouped as Pott's fractures. Thus of the 114 fractures of both bones, 111 are variants of the so-called Pott's type, the internal malleolus of the tibia being fractured, with the fracture of the fibula anywhere in the lower four inches. In the remaining three cases the fracture of the tibia is more extensive, for, in addition to the malleolus, a part of the lower end of the shaft is also fractured.

The 44 cases of fracture of the tibia alone, and the 108 cases of fracture of the fibula alone, were undoubtedly due to less severe trauma than the 111 cases of fracture of both bones. Thus, of the 44 cases of fracture of the lower end of the tibia alone, 40 involve the internal malleolus only. The remaining four cases involve more of the shaft, and may represent the type recently described by Cotton.

The 108 cases of fracture of the fibula alone show the line of fracture to be anywhere in the lower four inches of the shaft.

MEYER, LUDWIG. Fractured Femoral Exostosis. (*Berl. kl. Wchnschr.*, Vol. 53, No. 50, Dec. 11, 1916, p. 1340.)

Meyer, who is a military surgeon at the German front, describes the case of a patient who, falling from a chair, sustained a contusion at the inner side of the right knee just where he had experienced an uncomfortable pressure for about four years. After the fall he felt severe pains, and these together with a palpable hard swelling at the inner side of the femur gave rise to a roentgen examination. The latter showed at the lower end of the femur an exostosis which was distinctly fractured at the place of junction. The hemorrhage from the bone at the place of fracture was probably responsible for the violent pain. Operation confirmed the roentgenograms which are appended and give a perfectly clear illustration of the process. The fractured exostosis was successfully gouged out.

DIETRICH, A. Comparative Studies between Chondrodystrophy and Osteogenesis Imperfecta. (Tenth Anniversary of the Cologne Medical Academy. Ref. *Zentralbl. f. Roentgenstr.*, 1916, Nos. 5 and 6, p. 154.)

Dietrich had an opportunity to examine in detail three cases of grave congenital osseous changes which resembled each other in their external form. They presented the character of micromelia or shortlimbness, but the fundamental processes disclosed totally different conditions. The roentgenologist is particularly attracted by the characteristic roentgenograms, showing as they do the differentiation between the two affections.

PANOUPOULOS, GEORGES TH. (Athens). New Treatment of Tuberculosis. (*Proc. of the Royal Soc. of Med.*, London, Vol. IX, No. 8, June, 1916, p. 191.)

The Electrotherapeutic Section contains a communication from the author in which he gives a brief description of his method of destroying Koch's bacillus by ozone formed in the lungs by the action of hard roentgen rays on pure oxygen inhaled through a special apparatus designed to exclude atmospheric air. After the patient has inhaled pure oxygen for five minutes, the roentgen rays or other radioactive bodies are applied, the patient continuing to breathe the oxygen throughout the treatment. The object of rigidly excluding atmospheric air is to prevent the conversion of nitrogen into oxide of nitrogen which would of course have an injurious effect. A 0.5 to 2 mm aluminum filter is used, and the intensity

varies from 2½ to 8 H, each sitting to last from ten to twenty minutes. A very small portion of the oxygen which fills the lungs is converted into ozone by the action of the rays, setting up a bactericidal action. Incidentally, the treatment further insures:

(a) The increase of the beneficial oxidation of chemical combinations of the blood (hemospherine, hemoglobin, etc.) due on the one hand to the presence of a large quantity of oxygen, and on the other to the ionization of the oxygen, the oxidizing and diffusing action of which is increased as a result of the catalytic action of the roentgen rays.

(b) The influence brought to bear on the tubercles and the bacilli themselves.

As soon as he is in a position to work with two apparatus, the author will institute a cross-fire method from two sides which, he believes, will increase not only the quantity of ozone but also the activity of the rays and of the oxygen.

The results so far attained have been very encouraging, but the author invites others to verify the effect and communicate to him the results. His address is: Dr. Georges T. Panoupoulos, Chateaubriand 12, Athens, Greece.

McMahon, F. B., and Carman, R. D. Chronic Colitis and Its Roentgenologic Findings. (*Jour. Lab. and Clin. Med.*, Feb. 1917, Vol. II, 328.)

This paper comprises a study of a group of cases of chronic colitis in which marked pathologic changes occur in the intestinal wall resulting in inflammatory thickening, contraction, granulation, or ulceration. The disease occurs slightly more often in males than in females.

Repeated stool examinations are always essential as it is necessary to rule out the more common causes of chronic diarrhea. In these cases no intestinal parasites are found. It must be remembered, however, that in an entamebic colitis that has been treated with emetin, the stools may be free from parasites on several examinations and still some of the symptoms persist. Theoretically, tuberculous and other specific bacterial infections can be identified by centrifugation of a small portion of the stool contents and microscopic examination of properly stained smears. There is also usually a suggestive history and other symptoms and physical signs present in tuberculous and bacillary colitis cases. A history of luetic infection, other constitutional stigmata and the Wassermann reaction will put one on guard for the possibility of a syphilitic lesion in the lower part of the intestinal tract, although, of course, both conditions may be present. Fortunately syphilis of the rectum and colon is very rare.

The authors do not seem to be aware of the volume of work that has been done on colitis, referring only to the work of Schwarz, of Vienna. Schwarz, from his own experience and from the experience of others, to whom he gives due credit, describes the characteristic features in a small number of cases of chronic colitis. Among other things he includes the phenomena of a small and smooth bowel, absence of haustration and incompetence of the ileocecal valve. The authors found from an examination of a number of colons in chronic colitis that these conditions are invariably present and they wish to emphasize their importance. They feel that these roentgenologic phenomena are not due to spasm, but result from the organic alterations in the bowel wall, because definite pathologic changes are found in both the gross and microscopic appearance of all the coats. Furthermore, they are permanent and cannot be altered in their main appearances and characteristics by the administration of antispasmodics to physiologic effect prior to a second roentgen examination. The authors did not observe enterospasm during the roentgen examination in this type of colitis. It may be the reason for this is to be found in the fact that they studied the colon only after the enema, not after the meal also. This is probably explained by the fact that their studies were apparently all made with the barium enema, no observations being reported on the colon following a barium meal.

There are certain other conditions of the large bowel in which some of these phenomena may also be found to a varying degree; but, as a rule, they can be eliminated either by a correlation of the roentgen findings with the clinical data, or the roentgenogram alone may definitely indicate a lesion other than colitis. For example, in an occasional case of chronic constipation, the large bowel may be smooth and show no haustration. Exceptionally also, in cancer of the colon, the unaffected portion of the bowel may have smooth, unhaustrated borders. However, these findings are not constant. In such instances the lack of haus-

tration is doubtless due to relaxation of the longitudinal muscle bands—the tenia.

In a limited number of cases of chronic entamebic colitis the authors did not find a roentgenogram in any measure differing from the normal. The group included cases of long standing and of recent exacerbations but none that were prostrated. The authors believe that the roentgen examination offers distinct value in the differentiation of these two diseases, especially as seen in this latitude.

PANCOAST, H. K., AND HOPKINS, A. H. The Action of Pituitrin upon the Gastrointestinal Tract of Man. (*New York Med. Jour.*, Feb. 17, 1917, Vol. CV, p. 289.)

The roentgen studies of these authors constitute a very important and timely contribution to our knowledge of the subject. After due reference to the previous investigations upon the action of pituitrin, the authors conclude that from the literature there is a wide variability in the physiological activity of various commercial pituitary extracts. It has been suggested that there is in the posterior lobe some substance which has an action on the isolated intestinal loop of animals resembling the action of adrenalin, a substance, moreover, which may be other than that which raises the blood pressure and causes diuresis.

Pancoast and Hopkins used the same preparation throughout their studies, namely, pituitrin. Investigations were made upon eleven patients from the medical wards of the hospital of the University of Pennsylvania. Five patients were free from any gastrointestinal symptoms whatever, while the other six complained of constipation. So far as the authors were able to observe, the effects of the pituitrin did not differ materially in the last six cases from the preceding five who had no gastrointestinal symptoms. In studying the eleven cases, 104 roentgenoscopic examinations and 114 roentgenograms were made. The screen studies were more prolonged than is usual in the ordinary roentgen investigations of the digestive tract. The opportunity for the study of patients with postoperative atony and paresis of the intestine was not afforded, but the clinical results, as attested by surgeons and obstetricians, are quite sufficient evidence of the action in these cases.

The following is the technic used by the authors in their investigations: Following a bismuth or barium meal, the case was studied roentgenoscopically for twenty to thirty minutes in order to determine the nature of the peristalsis and to establish a mental picture of this and other factors included in the make up of the action of the stomach. Subsequently the case was studied at intervals of one to two hours, until the stomach was empty and the food column well advanced into the large bowel. As soon as the intestinal tract was found free of opaque contents the drug study was begun. A dose of one c.c. of pituitrin was given hypodermically from a minute or two up to twenty minutes before the administration of the second opaque meal. In some instances this dose was repeated once or twice at intervals of two to four hours. The studies were then made at exactly the same intervals as the controls. Only one case was under examination at a time to avoid confusion, and in order that the roentgenoscopic mental picture of the control might as nearly as possible be compared accurately with the observations of the drug series. Accurate notes were taken at each examination and roentgenograms were made at stated intervals.

In the stomach there was usually a primary depressing influence upon peristalsis or motility or both, followed by an increase of both. The same effect followed repeated doses. The pylorus was influenced very little, and when any effect was noted, it was variable. In the small intestine, motility was as a rule either not affected or was slightly delayed. In the large bowel, the drug produced little or no appreciable effect on motility in the class of patients examined. Nevertheless, the authors' experience has shown that their technic has not been such as would give the most accurate data with relation to the colon, and it is possible that a colonic investigation would have to be carried out entirely independent of that of the stomach and small intestine.

SIPPEL. Idiosyncrasy Against Roentgen Rays. (*Zentralbl. f. Gynäk.*, Nov. 4, 1916.)

Sippel reports two cases of cancer of the breast in old women treated by means of the roentgen ray. These cases were so similar throughout that one served as a perfect control for the other, so that the idiosyncrasy was readily appreciated. The patients were each

seventy-five years of age and each had diffuse cancer of the breast, beginning at the nipple. Considering their age, the health of both patients was good, but operation was contraindicated because of the quality of the heart action.

Under roentgenotherapy the tumor in each case showed a very satisfactory degree of retrogression. One woman received 24 applications in 14 months, the total dosage amounting to about 600 X units. The other patient received 462 X units in 22 séances during 18 months. In both cases the technic of the applications and the instruments were identical. The woman who had received the greater total dose experienced no inconvenience, while the other suffered a severe roentgen dermatitis over the entire area rayed. The author suggests that the difference in toleration of roentgen rays may have depended upon the fact that the woman who suffered the burn was a blonde, while the other was a brunette.

POTTER, HOLLIS E. The Roentgen Ray in the Diagnosis of Pyorrhea. (*Jour. Am. Med. Assoc.*, Vol. LXVIII, No. 6, Feb. 10, 1917, p. 416.)

The correct interpretation of roentgenograms of any part of the body is, as a matter of course, quite as important as the application of the correct technic in order to obtain a correct knowledge of the conditions to be investigated. This refers to dental roentgenography with the same force as to any other specialized application of the roentgen method, and dental surgeons look with ill-concealed displeasure upon what they consider an encroachment on the part of roentgen-trained physicians upon their own sphere of activity. This fear is unfounded. Every roentgenologist is aware of the fact, and freely acknowledges it, that the shadows of a roentgenogram can not be fully valued and rightly interpreted in a pathological condition except by an expert of that particular specialty. Just as little as a dental or, say, ophthalmological surgeon would attempt to diagnose gastro-enterological conditions from the roentgen plate, would a specialist of intestinal pathology differentiate between the niceties of a pyorrhea case, as depicted in a roentgenogram.

These general remarks serve to explain why Dr. Potter's instructive article on the roentgenological diagnosis does not lend itself to an abstract, as the details of it belong to the domain of the dental specialist and deserve the latter's earnest attention and study.

The trend of the article goes to show that a general survey of the denture by a series of dental films is an important adjunct to the examination of a pyorrhea case. It is often a short cut to a diagnosis and is less disagreeable than an instrumental examination, but would supplement rather than displace other diagnostic methods. The most important diagnostic points are observable in the region of the intimate bony investments of the roots and are obtainable only from the most critical roentgenograms.

Another important part of Potter's contribution is a description of the limitations in the value of the roentgen findings in pyorrhea. While these findings fairly well agree with the digital or instrumental examinations, certain disappointments may be encountered. Thus, when a pyorrhea tooth is quite loose, a well defined pocket might be expected in the roentgenogram, while, as a matter of fact, there may hardly be more than a simple loss of the normal white line. The author attributes this to the atrophy being diffuse and poorly demarcated. Again, a tooth which shows no looseness on examination may roentgenographically show a very deep pocket, due to the escape from the disease of a limited portion of the investing structures which is not recognizable on the plate, but sufficient to maintain the stability of the tooth. Frequently, roentgenograms are quite similar in cases where gross amounts of infective material can be expressed from the jaw and where the disease in all its clinical manifestations is entirely quiescent or only slowly advancing.

In short, pyorrhea again presents one of those contingencies where the interests of the patient are best served by the combined application of the knowledge of the expert roentgenologist and the expert dental specialist.

BOOK REVIEWS

THE MEDICAL CLINICS OF CHICAGO, May, 1917, Vol. II, No. 6, published by the W. B. Saunders Company, Philadelphia.

This is the final issue of the second volume of the Medical Clinics of Chicago. It contains relatively less of interest to roentgenologists than most issues of this valuable periodical. However, it must not be forgotten that the larger the clinical experience of the man who undertakes *X*-ray work, the greater will be the range of his usefulness in the interpretation of *X*-ray findings; hence, it is not saying too much to urge that these clinics should be in the hands of every roentgenologist.

The clinic by Smithies on enterocolitis is of interest to the reviewer because of the confirmation of the finding first reported by the reviewer that in cases of chronic enterocolitis there is nearly always observed a noticeable reflux of cecal contents into the terminal ileum —so-called incompetency of the ileocecal valve.

The clinic by Dr. Milton L. Portis on carcinoma of the esophagus again shows the stamp of its usual commendable impress. First an outline relative to the pathology, symptoms, diagnosis, treatment and prognosis, then a detailed discussion of the cases. Excellent photographs of specimens and roentgenograms of the cases under discussion add much to the value of the clinic.

A case of carcinoma of the hepatic flexure is presented by Dr. C. L. Mix in a characteristically interesting manner. The roentgenograms published look suspiciously like a case of carcinoma of the stomach. There is a constant irregularity of the pyloric portion of the stomach reaching up to, but not involving, the pylorus. The author does not discuss the cause of the filling defect in the shadow of the stomach.

A very interesting clinic by Dr. Frederick Tice concerns luetic infections of the lungs. Dr. E. S. Blaine is given credit for the roentgen findings and the roentgenological interpretation of the lung lesions and associated bone lesions.

WHERE THE NORMAL ENDS AND THE PATHOLOGICAL BEGINS—ROENTGENOLOGICALLY CONSIDERED. By Alban Koehler. Second Edition, 1915. Graefe & Sillem, Hamburg. Price M. 10.00.—Book Review in the *Muench. med. Wchnsch.*, Feb. 22, 1916, p. 278.

Koehler's "Lexicon" should have a place in every roentgen laboratory. The second edition, which has just left the press, is twice as voluminous as the first. The gastrointestinal section in particular has been materially enlarged as well as enriched by numerous illustrations. The large crop of books and journals of the last five years has been carefully sifted and critically considered. The index is likewise a welcome addition. The book is a useful guide to the beginner to find his way through the maze of pitfalls a roentgen diagnosis has in store for him, and it is equally useful to the experienced physician, especially to that large number of the profession who have war duties to perform. It is an indispensable dictionary for the use of the roentgenologist and a reliable guide to the various sources of roentgen literature.